It is certified that a copy of this Protest has been served in its entirety on the applicant's attorney of record pursuant to 37 C.F.R. §§ 1.291(a)(2) and 1.248 by first class mail on April 15, 2005. The name and address of the attorney of record served is: Richard J. Ward, Jr., Christie Parker & Hale, LLP, P.O. Box 7068, Pasadena, CA 91109-7068.

Dated: April 15, 2005 Signature: David L. Fehrman
(David L. Fehrman)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Reissue Patent Application of:
WASHINO ET AL.

Serial No.:	10/004,046	Group No.:	2614
Filing Date:	October 24, 2001	Examiner:	David E. Harvey
Title:	MULTI-FORMAT AUDIO/VIDEO PRODUCTION SYSTEM		

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
ATTENTION: Technology Center 2600

ok to enter
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PROTEST RELATING TO NEW CLAIMS UNDER 37 C.F.R. § 1.291(c)

This Protest is filed on behalf of the following companies: Amazon.com, Inc., Buena Vista Home Entertainment, Inc., DreamWorks LLC, Funai Electric Co., Ltd., LG Electronics Inc., Lions Gate Entertainment Inc., Metro-Goldwyn-Mayer Studios Inc., the Motion Picture Association of America (MPAA), Paramount Pictures Corporation, Pioneer Electronics (USA) Inc., Playboy Entertainment Group, Inc., Samsung Electronics Co., Ltd., Sanyo Electric Co., Ltd., Sharp Corporation, Sony Electronics Inc., Sony Pictures Entertainment Inc., Thomson, Inc., Toshiba America Information Systems, Inc., Twentieth Century Fox Film Corporation, Victor Company of Japan, Ltd., the Video Software Dealers Association (VSDA), Vivendi-Universal Entertainment LLLP, Wal-Mart Stores, Inc., and Warner Bros. Entertainment Inc. (the "Protestors").

This Protest follows the December 6, 2004 Amendment filed by applicant Multi-Format, Inc. ("Multi-Format") in connection with the above-identified reissue application. By the December 6, 2004 Amendment, Multi-Format cancelled all previously pending claims (26-255)

and added 38 new claims (256-293), all of which are substantially different from the cancelled claims. This Protest is directed to the newly-added claims and addresses issues that have particular application to those claims, including restriction acquiescence, recapture estoppel, written description, and the applicability of certain prior art references. Accordingly, this Protest "raises new issues which could not have been earlier presented," and is appropriate under 37 C.F.R. § 1.291(c).[1] In addition, this Protest discusses the relevance of newly-identified prior art to the new claims, providing a further basis for this submission. *See* 37 C.F.R. § 1.291(c) (providing that submission of "additional prior art" warrants further protest).

INTRODUCTION

By its December 6, 2004 Amendment, applicant Multi-Format cancelled all previously pending claims and added 38 new claims (256-293) in their place, with newly-added claims 256, 276 and 285 being independent. New claim 256 is directed to an audio-visual method including the steps of receiving video and audio information, performing non-linear editing, and storing the edited video information. New claim 276 is directed to a system for capturing and recording digital video information including a video camera and a digital video recorder. New claim 285 is a method claim corresponding to the system recited in claim 276.

As discussed in detail below, all of these new claims, as well as the claims that depend from them, are barred by the doctrine of restriction acquiescence. The new claims are also barred by the doctrine of recapture estoppel. Because the issues of restriction acquiescence and

[1] In its December 22, 2004 "Response to Protest Under 37 C.F.R. § 1.291(a)" ("Response to Protest"), Multi-Format asserted that the December 6, 2004 Amendment moots the arguments made in the July 12, 2004 "Protest Under 37 C.F.R. § 1.291(a)" ("July 12, 2004 Protest"). On this point, Multi-Format contended that "the landscape of the pending claims was changed. Previously pending claims 26-255, to which the arguments of the protest were directed, were canceled, and new claims 256-293 were added. The language of the new claims differs from that of the previously pending claims, and none of the arguments of the protest are directed to the new claims . . .." (Response to Protest at 3.) Thus, Multi-Format has implicitly conceded that this Protest clearly "raises new issues which could not have been earlier presented" by the July 12, 2004 Protest. Applicant's new claims 256-293 essentially present an entirely new application which justifies the filing of a new Protest.

recapture estoppel are specific to particular claims, the manner in which these doctrines apply to the newly-submitted claims could not possibly have been addressed in the July 12, 2004 Protest.

The new claims are also unpatentable over prior art – both prior art previously of record and additional prior art not of record. The manner in which the prior art renders the claims unpatentable is discussed in detail below. Finally, new reissue claims 256-275 lack an adequate written description with respect to the common claim term "non-linear editing," and dependent claims 261-263 fail to meet the written description requirement for additional reasons, thereby providing independent bases for finding such claims unpatentable under 35 U.S.C. § 112, ¶ 1.

None of the issues raised herein could have been raised before the new claims were presented.

I. NEW CLAIMS 256-293 ARE BARRED DUE TO THE DOCTRINE OF RESTRICTION ACQUIESCENCE[2]

New claims 256-293 are directed to inventions that were not elected in response to the restriction requirement made during prosecution of the original application that issued as U.S. Patent No. 5,537,157 ("the '157 patent"). The new claims are <u>not</u> generic claims that link different species. Each of the new claims is directed to an invention that could <u>not</u> have been prosecuted following the election made during prosecution of the original '157 patent. Accordingly, such claims cannot be prosecuted in this reissue application.

A. Restriction Requirement and Voluntary Election in the Original Application

In an April 10, 1995 Office Action during the prosecution of the '157 patent, the original Examiner issued a restriction requirement between two subcombinations: Group I (including application claims 1-20), characterized by the Examiner as being "drawn to a system for converting an image into multiple format," and Group II (including application claim 21),

[2] The legal standards associated with the doctrine of restriction acquiescence were set forth in the July 12, 2004 Protest and will not be repeated here.

characterized by the Examiner as being "drawn to a video production system for generating an image." The Examiner stated that "Inventions I and II are related as subcombinations disclosed as usable together in a single combination." The Examiner then explained how the subcombinations are distinct from each other and why restriction was proper. (*See generally* April 10, 1995 Office Action at 8-9.)

In response to the restriction requirement, the applicant for the '157 patent voluntarily elected to prosecute the claims of Group I, but failed to file a divisional application as to the non-elected claims. The application for the '157 patent was thus restricted to prosecution of claims directed to that <u>one</u> particular subcombination, *i.e.*, a system for converting an image into multiple formats. After the restriction and acquiescence, <u>no</u> other subcombinations could have been prosecuted – whether in the original application or by reissue of the '157 patent that issued from the original application.

B. None of the Newly Added Claims in the Present Application are Directed to the Originally Elected Subcombination and Therefore Cannot Be Allowed

The newly added claims should be rejected due to lack of error supporting reissue because they are not directed to the subcombination that was voluntarily elected by applicant in the original application following the Examiner's restriction requirement – a system for converting an image into multiple formats. *See* Manual of Patent Examining Procedure (MPEP) §§ 806 and 806.05(d).

The reissue application now includes three independent claims: claims 256, 276, and 285. New independent claim 256 is directed to an audio-visual method that includes the steps of receiving video and audio information, performing non-linear editing, and storing the edited version of the video information on a high-capacity storage medium. In other words, new claim 256 is <u>not</u> directed to a system for converting an image into multiple formats. Also, no

claim that depends from new claim 256 is directed to a system for converting an image into multiple formats. New claim 256 and its dependent claims are directed to a completely different subcombination than the subcombination that was elected during prosecution of the original '157 patent and cannot therefore be prosecuted in this reissue application. Once a particular subcombination is elected, an applicant has no right whatsoever to prosecute claims directed to other subcombinations. That is the very purpose of a restriction requirement.

Similarly, new independent claims 276 and 285 (and their dependent claims) are <u>not</u> directed to a system for converting an image into multiple formats, *i.e.*, the subcombination that was elected during prosecution of the original '157 patent in response to the restriction requirement. These claims are directed to a video camera and digital-video recorder and corresponding method, which are completely different from the originally elected subcombination.

It is also noted that Multi-Format filed a "Supplemental Declaration for Reissue Patent Application" on March 11, 2005, indicating that the error to be corrected in the reissue is that the '157 patent did not include claims directed to "an audio visual method wherein editing is performed on video information in a digital format having a frame rate of substantially 24 frames per second (fps) in a non linear manner and the edited video information is then stored on a high capacity storage medium in a format of compressed digital video having a frame rate of substantially 24 fps[.]" This statement further demonstrates that the new claims are directed to an invention that is completely different from the elected subcombination (which was a system for converting an image into multiple formats).

The present scenario is controlled by *In re Watkinson*, 900 F.2d 230, 14 U.S.P.Q.2d 1407 (Fed. Cir. 1990) and *In re Weiler*, 790 F.2d 1576, 229 U.S.P.Q. 673 (Fed. Cir. 1986). In *Weiler*, the Federal Circuit provided as follows:

> Significantly, Weiler accepted issuance of the '923 patent with its claims to a single elected invention. By acquiescing in the examiner's restriction requirement, and failing to file divisional applications on the subject matter of non-elected claims, Weiler foreclosed (because that was not error) his right to claim that subject matter. If it were not error to forego divisional applications on subject matter to which claims had been made in the original application, it cannot on the present record have been error to forego divisional applications on subject matter to which claims had never been made.

790 F.2d at 1582. Thus, new claims 276 and 285 (and their dependent claims) cannot be prosecuted in the current reissue application because they are not directed to the subject matter to which the original application was voluntarily restricted.

C. Applicants' Arguments Relating to the Protestors' Characterization of the Subject Matter of the Elected Claims are Both Misguided and Precluded

In its Response to the July 12, 2004 Protest, Multi-Format accused the Protestors of attempting to mislead the Examiner "by mischaracterizing the subject matter of claims 1-21." (Response to Protest at 9, footnote 4.) However, this supposed "mischaracterization" originates not from the Protestors but <u>from the Examiner</u> himself: it is a <u>word-for-word</u> recitation of the characterization of claims 1-20 given by the Examiner in his restriction requirement in the April 10, 1995 Office Action. If the applicant believed that the Examiner had incorrectly characterized the invention defined in claims 1-20 during prosecution of the original '157 patent, it was incumbent upon the applicant to dispute the characterization <u>then</u>. However, the applicant did no such thing. Rather, the applicant acquiesced in the restriction requirement, elected the subcombination of Group I, and failed to file any divisionals. Multi-Format can hardly accuse the Protestors of mischaracterizing the invention and attempting to mislead the Examiner here

when the Protestors did nothing more than adopt a verbatim recitation of the original Examiner's restriction requirement which is already of record.

Moreover, Multi-Format is precluded from challenging the propriety of the underlying restriction requirement at this time. After having acquiesced in the restriction requirement, having voluntarily elected the claims of the Group I subcombination, and having canceled the non-elected claims, applicant cannot now recharacterize the claims of the original application or ignore the original Examiner's characterization of the claims. This situation was dealt with directly in *In re Watkinson*:

> [W]e . . . hold that the failure to file a divisional application, <u>regardless of the propriety of the underlining restriction requirement</u>, is not an error correctable by reissue under 35 U.S.C. § 251.

900 F.2d at 231-32 (emphasis added). As explained by the Federal Circuit in *Watkinson*, after acquiescing in a restriction requirement and canceling the non-elected claim, the applicant lost the opportunity to challenge the propriety of the restriction requirement. *Id.* at 233.

D. Restriction Acquiescence Cannot be Avoided by Reference to Original Dependent Claims

Multi-Format essentially seeks to circumvent the restriction to a particular subcombination by pointing the Examiner in the direction of dependent claims and asserting that an applicant is free to submit claims directed to the subject matter of the dependent claims by themselves, <u>without including the subcombination that was originally elected</u>. This cannot be permitted, as it would effectively eviscerate the original restriction requirement. Again, during prosecution of the original '157 patent, the applicant elected to prosecute claims directed to "a system for converting an image into multiple format" in several independent claims, and, therefore, can pursue by reissue <u>only</u> claims that include this same subcombination.

Multi-Format asserts that new reissue claims 256-293 are "broader claims drawn on the elected claims, **not** on the non-elected claims," and maintains that the new claims could have been included with the original application that contained the elected claims. (Response to Protest at 11.) Not only are Multi-Format's assertions incorrect, they are irrelevant.

In purported support, Multi-Format provides an example of original claims "directed to digital cameras," referring to original claims 5 and 6. (*Id.* at 12.) Essentially, Multi-Format is arguing that as long as it continues to include at least one limitation from <u>any</u> original claim, it could have prosecuted such claim in the original '157 patent. This is, of course, not the case. Multi-Format has dug down into a dependent claim, which adds another (non-elected) subcombination, <u>and has then completely eliminated the elected subcombination that was in the independent claims</u>. In other words, all that is left are the elements of non-elected subject matter <u>without</u> the originally elected subcombination. By doing this, Multi-Format is no longer claiming the original subcombination that was elected, but has shifted over to claim a completely <u>different</u> subcombination. This is precisely the type of legally impermissible tactic prohibited by *Watkinson* and *Weiler*.

The fact that dependent claims added limitations to additional subcombinations does not mean that Multi-Format is free to ignore the originally-elected subcombination set forth in the original independent claims of the '157 patent. The elected subcombination cannot be eliminated by reissue and substituted with several different subcombinations, as Multi-Format attempts to do here.

On page 11 of its Response to Protest, Multi-Format maintains that the new reissue claims 256-293 are "not substantially similar to non-elected original claim 21." Again, this is

completely irrelevant and flips the required analysis on its head. As stated in *Ex Parte Pagilagan*, Appeal No. 2001-1752, 2002 Pat. App. LEXIS 198 (B.P.A.I. 2002):

> Appellant's focus on differences between the reissue claims and the non-elected claims misplaces the focus of the inquiry. Whether the subject matter presented in the reissue claims is patentably distinct from the subject matter of the non-elected claims is not the issue. The issue is whether Appellant had a right to claim the subject matter now claimed in the original patent. It cannot be "error" to fail to include claims to subject matter which Appellant had no right to include in the first place. There was no right to claim a process in the original patent because Appellant acquiesced in a restriction requirement that limited the claims to a copolyamide composition and articles. If the Applicant cannot claim the subject matter in the original application, he has no "right to claim" it in the reissue.

Id. at *16-*17. After the restriction and election, the applicant had no right to claim any non-elected subcombination in the original '157 patent, and Multi-Format has no right to claim it now in this reissue application.

E. *In re Doyle* is Not Relevant to Restrictions Relating to Subcombinations

Finally, Multi-Format's reliance upon *In re Doyle*, 293 F.3d 1355, 63 U.S.P.Q.2d 1161 (Fed. Cir. 2002), in its effort to obtain claims to inventions other than the originally-elected subcombination, is entirely misplaced. The current reissue application implicates the issue of whether claims to different <u>subcombinations</u> can be presented after restriction and election of a single subcombination. In contrast, *Doyle* was concerned with the situation of a <u>species</u> restriction and the ability to prosecute a generic claim following a species restriction and election. *Doyle* simply recognizes that following restriction to a particular species, an applicant is free to prosecute a generic claim that links different species. (This practice is governed by 37 C.F.R. § 1.146 and discussed in MPEP §§ 809.02 and 809.02(a).) The reason for this is clear: the generic claim still reads on the elected species. The Federal Circuit in *Doyle* concluded that a

generic or linking claim could be prosecuted in reissue because such claim could have been prosecuted in the original application even after the election of a single species.

Contrary to the genus/species situation, once an election to a particular subcombination is made – as it was in the original '157 patent – the applicant has no right whatsoever to prosecute claims that are not directed to the elected subcombination. Rather, by acquiescing to a restriction to a particular subcombination, claims directed to <u>any</u> other subcombination can be presented only by way of a divisional application. In adding new reissue claims 256-293, Multi-Format baldly states, without any basis whatsoever, that all of the new claims could have been prosecuted in the original application following the restriction and election. (Response to Protest at 11.) This simply is not true. Because the original application was restricted to one particular subcombination, the reissue application can present only claims directed to that subcombination.

II. NEW CLAIMS 256-293 ARE BARRED UNDER THE DOCTRINE OF RECAPTURE ESTOPPEL[3]

In view of the cancellation of all of the previous claims by Multi-Format, and the submission of an entirely new set of claims, the new claims must be freshly analyzed to determine the applicability of the recapture doctrine. Upon review of the newly submitted claims in the context of the prosecution history of the original '157 patent, it becomes apparent that these new claims are also barred under the recapture doctrine.

On page 16 of its Response to Protest, Multi-Format asserts that "the <u>only</u> limitation added to avoid the prior art was the inclusion of high-capacity video storage used to store video information in a particular format." (Emphasis added.) By this assertion, Multi-Format tries to avoid the fact that claim 1 of the '157 patent was specifically amended to state that the graphics processor converts the display format of the program into an intermediate production format.

[3] The legal standards associated with the doctrine of recapture estoppel were set forth in the July 12, 2004 Protest and will not be repeated here.

Multi-Format pretends that this amendment was made not for patentability purposes, but rather to provide antecedent basis for the function of the high-capacity storage means. Multi-Format's argument, however, is completely belied by the prosecution history of the '157 patent. Indeed, Multi-Format's assertion that the August 11, 1995 Amendment was not made for patentability purposes is belied by the contemporaneous remarks it made in connection with that amendment:

> Claims 1-4, 8-11 and 13-20 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Hailey, U.S. Patent No. 5,243,433. Claim 1 has been amended to include high-capacity video storage means and an aspect always present in independent claims 13 and 17, that is, an internal production or 'working' format which may be stored and/or used as the basis for input to the interface units so as to create a standard/wide-screen or HDTV output formatted imagery. Hailey neither implies nor suggests the use of such an intermediate format, nor does Haley include any means for the storage of images, temporarily or permanently during conversion directly from an input format to an output format.

(August 11, 1995 Amendment at 10; emphasis added.)

Thus, the applicant explicitly distinguished U.S. Patent No. 5,243,433 to Hailey ("Hailey") through its remarks that claim 1 was amended to include the use of an internal production format in addition to video storage means. Both limitations were clearly argued to distinguish over Hailey. Moreover, the argument regarding conversion to an intermediate format was directed to all of the independent claims. The prosecution history of the '157 patent could not be any clearer. The applicant specifically argued the limitation contained in each of the independent claims regarding conversion into an intermediate production format to distinguish over Hailey.

Multi-Format attempts to minimize the impact of the August 11, 1995 Amendment and the applicant's argument regarding conversion into a production format by asserting that the amendment and argument were not the reason the claims were allowed by the Examiner. Multi-Format maintains that there was no surrender with respect to converting the input program to a

production format "because this limitation was not added during prosecution of any claim to overcome the rejection to Hailey." (Response to Protest at 18.) As discussed above, this statement is untrue. Moreover, the Examiner's reaction to the surrendering amendment made by the applicant is completely irrelevant. The only relevant inquiry is what the applicant surrendered in its efforts to distinguish over the prior art. In effect, Multi-Format is arguing that the surrender of subject matter during the original prosecution was not necessary, because the Examiner did not allow the claims based upon such surrender. Again, whether or not the surrender was necessary, or "successful," is irrelevant. *See In re Clement*, 131 F.3d 1464, 1471, 45 U.S.P.Q.2d 1161 (Fed. Cir. 1997) ("every time Clement amended his claims, he intentionally omitted or abandoned the claimed subject matter") (emphasis added). It is the applicant's surrender of subject matter in response to a rejection – not the Examiner's response (or lack thereof) to the surrender – that is relevant.

As noted in *Clement*, the recapture rule "prevents a patentee from regaining through reissue the subject matter that he surrendered in an effort to obtain allowance of the original claims." *Id.* at 1468 (emphasis added). Multi-Format most certainly surrendered claim coverage that did not include conversion into a production format through both amendment and argument. Nothing was ever done during the prosecution of the original '157 patent to undo that surrender.

The surrender-generating limitation of conversion into a production format is completely absent from newly-submitted claims 256-293. Thus, recapture estoppel clearly applies. Multi-Format cannot simply eliminate a limitation that was specifically added and/or argued in an effort to obtain allowance of the claims.

Multi-Format's reliance upon *Ex Parte Eggert*, 67 U.S.P.Q.2d 1716 (Bd. Pat. App. & Inter. 2003) (*see* Response to Protest at 19) is misplaced, because, as discussed above, the

limitation regarding conversion into a production format has been entirely omitted. *Eggert* only applies when a surrender limitation is not entirely omitted, but rather is recited in a broader form. Here, the new claims contain absolutely no recitation of conversion into a production format.

III. NEW CLAIMS 256-275 ARE UNPATENTABLE UNDER 35 U.S.C. § 112, ¶ 1 FOR FAILURE TO SATISFY THE WRITTEN DESCRIPTION REQUIREMENT

A. The '157 Patent Does Not Provide Written Description Support for the Method of Independent Reissue Claim 256

New independent claim 256 recites an "audiovisual method" comprising three separate steps, including "performing non-linear editing on the video information in its digital format to create an edited version of the video information," and "storing the edited version" in a "compressed" format, which implicitly requires performing the "non-linear editing" step before the "storing" step. December 6, 2004 Amendment (emphasis added). The claim term "non-linear editing" is common to independent claim 256 and its dependent claims 257-275. However, this claim term is not common in the '157 patent, as it makes only a solitary appearance in the more than 13 columns of text in the original specification, is absent from the figures of the '157 patent, and has never appeared in any of the hundreds of claims presented before the recent December 6, 2004 Amendment. The named inventors, however, made a throwaway reference to "non-linear-editing" in the original '157 patent, which Multi-Format now attempts to conflate into the basis for 20 new claims in violation of the written description requirement of 35 U.S.C. § 112, ¶ 1.

1. The Term "Non-Linear Editing" was Merely Mentioned Once, in Passing, in the Original '157 Patent

The '157 patent mentions "non-linear editing" only once in passing:

> In particular, techniques such as non-linear-editing, animation, and special-effects will benefit from the implementation of this system.

('157 patent, Col. 4, lines 56-58; emphasis added.) Other than that single reference, there is absolutely no discussion of "non-linear-editing" in the '157 patent. There is no explanation as to what constitutes a "non-linear-editing" technique, nor elucidation regarding any "benefit" that the "non-linear-editing" technique will allegedly realize from implementation of the system described in the '157 patent. Moreover, there is no disclosure of how to "perform[] non-linear editing on [] video information" nor is there any suggestion of the specific order of steps to be performed – "non-linear editing" <u>before</u> "storing" – in the method now claimed by Multi-Format more than a decade after the application for the '157 patent was filed.

Multi-Format has taken advantage of a passing reference about a "benefit" and the passage of time to lay claim to technology that obviously was not contemplated by the named inventors at the legally critical juncture of when they applied for the '157 patent. If they really had invented an "audiovisual method" in which "non-linear editing" was performed on video information before storage in a "compressed" format, the named inventors would have demonstrated that they possessed this technology by actually describing such a process in the '157 specification. The vague throwaway reference in the original specification – that "non-linear editing" is one of many techniques which will "benefit" from the "invention" as originally claimed – does not say whether one should edit and then compress, or vice versa.

2. The Performance of "Non-Linear Editing" Prior to Storage is Not Adequately Described in the '157 Patent

The term "non-linear editing" was added to the claims by amendment. "Any such amendment or insertion must comply with all statutes and regulations." *Kingsdown Med. Consultants, Ltd. v. Hollister Inc.*, 863 F.2d 867, 874, 9 U.S.P.Q.2d 1384 (Fed. Cir. 1988). Of course, included among the "statutes and regulations" that must be observed is the first paragraph of Section 112 which provides:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

35 U.S.C. § 112, ¶ 1. This statutory provision contains three separate and independent conditions on patentability, respectively referred to as the "written description," "enablement" and "best mode" requirements. *See Univ. of Rochester v. G.D. Searle & Co.*, 358 F.3d 916, 920-21, 69 U.S.P.Q.2d 1886 (Fed. Cir. 2004). Multi-Format's new claims 256-275 violate at least the first of these requirements.

To satisfy the "written description" requirement, a patent applicant is required to "convey with reasonable clarity to those skilled in the art that, as of the filing date sought, he or she was in possession of the invention." *Vas-Cath, Inc. v. Mahurkar*, 935 F.2d 1555, 1563-64, 19 U.S.P.Q.2d 1111 (Fed. Cir. 1991). "An applicant complies with the written description requirement 'by describing the invention, with all its claimed limitations.'" *Gentry Gallery, Inc. v. Berkline Corp.*, 134 F.3d 1473, 1479, 45 U.S.P.Q.2d 1498 (Fed. Cir. 1998) (quoting *Lockwood v. American Airlines, Inc.*, 107 F.3d 1565, 1572, 41 U.S.P.Q.2d 1961 (Fed. Cir. 1997)).

Multi-Format is attempting to take undue advantage of the patent system and its reissue procedures to claim entitlement to something it did not invent, in contravention of the written description requirement. "The purpose of the written description requirement is to prevent an applicant from later asserting that he invented that which he did not[.]" *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1330, 65 U.S.P.Q.2d 1385 (Fed. Cir. 2003). The requirement of an "[a]dequate description of the invention guards against the inventor's overreaching by insisting that he recount his invention in such detail that his future claims can be

determined to be encompassed within his original creation." *Vas-Cath*, 935 F.2d at 1561 (quotation and citation omitted).

Multi-Format is "overreaching" in claiming to have invented an "audiovisual method" that includes "performing non-linear editing" on video information before storing the same in "compressed" format. When the inventors filed the original application, they only noted in passing that "techniques such as non-linear-editing, animation, and special-effects will benefit from the implementation of this system," without offering any clue as to how one would actually use non-linear editing, *e.g.*, edit before storing in compressed form, or edit the compressed video and display the edited version, or store the edited version in an uncompressed form. In short, the specification as filed did not contain any description of the presently-claimed process. The off-hand reference in the '157 patent to three types of techniques that will purportedly realize a "benefit" from implementation of the claimed system cannot satisfy the written description requirement as to a particularly limited actual use of one of them.

B. Dependent Reissue Claims 261-263 Suffer Additional Written Description Deficiencies

New reissue claims 261-263 each depend directly from independent claim 256 and further limit the recited "audiovisual method" by respectively specifying that the "video and audio information" of claim 256 are received by (1) "an interface to a high-bandwidth data network" (claim 261), (2) "a satellite receiver" (claim 262) or (3) "a broadcast signal receiver" (claim 263). However, there is no disclosure whatsoever in the original '157 patent that 24 frames per second video is provided from any of a high-bandwidth data network, a satellite receiver or a broadcast signal receiver, and these dependent claims are therefore unpatentable under § 112, ¶ 1 for this additional written description deficiency.

In this regard, Multi-Format's reference to column 12, lines 26-42 and Figure 6 of the '157 patent (*see* Response to Protest at 22) does not at all provide support for new claims 261-263. The input shown in Figure 6 is film, *not* a network or receiver. In addition, there is no indication that "locally produced materials" are provided from a high-bandwidth data network, satellite receiver or broadcast signal receiver. Such items are not local. Column 13, lines 23-26 of the '157 patent (*see* Response to Protest at 22) also does not support these claims; there is no disclosure that anything received by elements 210-214 is subsequently subjected to "non-linear editing" and then stored. Nor is there any disclosure that 24 frames per second video is provided by satellite, broadcast television or a high-bandwidth data network. The frame rate of the signals supplied to receivers 210, 212 and network interface 214 is unspecified. Indeed, the same drawing shows a "graphic processor 242" which converts, *inter alia*, "frame rates" of the various signals received by these units ('157 patent, Col. 13, lines 50-54). Dependent claims 261-263 are therefore also unpatentable for this additional failure to satisfy the written description requirement.

IV. NEW REISSUE CLAIMS 256-293 ARE UNPATENTABLE IN VIEW OF THE PRIOR ART

It is submitted that all of the new claims 256-293 filed by Multi-Format are unpatentable over numerous prior art references, some of which were previously of record.

A. Identification Of New Prior Art

The following four prior art references have not previously been made of record during the prosecution of the current reissue application (Reissue Application Ser. No. 10/004,046) and are attached hereto as Exhibits 1-4.

1. **U.S. Patent No. 5,355,450 to Garmon et al.**

U.S. Patent No. 5,355,450 to Garmon et al. ("the Garmon patent") issued on October 11, 1994 from an application filed on April 10, 1992. The Garmon patent is therefore prior art to the '157 patent – and thus Multi-Format's pending reissue application – under at least 35 U.S.C. § 102(e).[4] A copy of the Garmon patent is attached hereto as Exhibit 1.

The Garmon patent is assigned to Avid Technology, Inc. ("Avid") and is incorporated by reference in U.S. Patent No. 5,930,445 to Peters et al. ("the Peters patent") which is also assigned to Avid. U.S. Ser. No. 07/866,829, incorporated by reference in the Peters patent (*see* Peters patent, Col. 1, lines 26-30), is the Garmon patent. Due to this incorporation by reference, the Garmon disclosure is effectively a part of the Peters patent. *See Advanced Display Sys. v. Kent State Univ.*, 212 F.3d 1272, 1282, 54 U.S.P.Q.2d 1673 (Fed. Cir. 2000) ("Material not explicitly contained in the single, prior art document may still be considered for purposes of anticipation if that material is incorporated by reference into the document."); *Ultradent Prods. v. Life-Like Cosmetics*, 127 F.3d 1065, 1069, 44 U.S.P.Q.2d 1336 (Fed. Cir. 1997). The Peters patent (discussed *infra*) was one of the primary references cited during the prosecution of Multi-Format's original reissue application (now U.S. Patent No. RE 38,079). The first-named inventor on the Peters patent (Eric C. Peters) is also one of the named inventors on the Garmon patent.

2. **U.S. Patent No. 5,267,351 to Reber et al.**

U.S. Patent No. 5,267,351 to Reber et al. ("the Reber patent") issued on November 30, 1993 from an application filed on December 22, 1989. The Reber patent is therefore prior art to

[4] Multi-Format's pending reissue application claims priority to the '157 patent which issued on July 16, 1996 from U.S. Patent Appl. Ser. No. 08/298,104 ("the '104 application") which was filed on August 30, 1994. While the '104 application purports to be a continuation-in-part of U.S. Patent Appl. Ser. No. 08/050,861 ("the '861 application"), which was filed on April 21, 1993, there is no claim by Multi-Format that pending reissue claims 256-295 are supported by the '861 application. Thus, for purposes of this Protest, it is assumed that the pending reissue claims have a priority date no earlier than the August 30, 1994 filing date of the '104 application.

the '157 patent – and thus Multi-Format's pending reissue application – under at least §§ 102(a) and (e). The Reber patent is also assigned to Avid (and Mr. Peters is also one of the named inventors on the Reber patent). This Avid patent contains the following description of non-linear editing:

> Non-linear editing on computer oriented systems involves digitizing media data recorded from a linear source, e.g., a video tape cassette, and storing the digitized media data on a storage device, e.g., a hard disk drive. Once digitized, the media data can be accessed quickly at any point in the linear sequence in which it was recorded so that the various portions of the data can be accessed and edited in a non-linear way.

(Reber patent, Col. 1, lines 13-21.) A copy of the Reber patent is attached hereto as Exhibit 2.

3. Article Entitled "A Real Time, Object Oriented, Non-Linear Editing System For Film And Video" by Eric C. Peters

Eric C. Peters of Avid is a named inventor on each of the above-mentioned Garmon, Reber and Peters patents assigned to Avid. In addition, Mr. Peters authored a prior art article entitled "A Real Time, Object Oriented, Non-Linear Editing System For Film And Video" ("the Peters article") which details non-linear editing and the development of such an editing system by Avid. The Peters article is cited as prior art on the Peters patent, and with a presentation/publication date of October 1989, the Peters article is prior art to the '157 patent – and thus Multi-Format's pending reissue application – under §§ 102(a) and (b).

On page 9 of the Peters article, film features, including editing material entirely in 24 frames per second mode, are discussed. The Peters article also discusses the implementation of various effects such as squeeze and pan. A copy of the Peters article is attached hereto as Exhibit 3.

4. Article Entitled "Pixels and Halide – A Natural Partnership?" by David J. Bancroft

The May 1994 edition of the *SMPTE Journal* (at pages 306-311) contains a prior art article by David J. Bancroft entitled "Pixels and Halide – A Natural Partnership?" ("the Bancroft article"). As set forth on its cover page, the presentation of the Bancroft article was given on October 30, 1993 at the SMPTE Technical Conference, and the Bancroft article is therefore prior art to the '157 patent – and thus Multi-Format's pending reissue application – under § 102(a). While the Bancroft article was cited as prior art during the prosecution of Multi-Format's original reissue application (now U.S. Patent No. RE 38,079), it has not been cited to date during the prosecution of the reissue application that is the subject of this Protest.

The Bancroft article describes a system in which film is converted to a common production format of 24-frame per second progressive scan video for various processing steps, including editing. After processing, the signal is converted to one of numerous different video outputs, including 4:3 and 16:9 aspect ratios, anamorphic and HDTV at various frame rates. This operation is discussed at page 307 of the Bancroft article and is illustrated in Figure 3 of the article. Figure 10 of the Bancroft article also illustrates recording in a 24-frame per second format and playing back in several formats. A copy of the Bancroft article is attached hereto as Exhibit 4.

B. References Previously of Record

The following prior art references are already of record in this reissue application. It is submitted that these references, either alone or in combination with one or more of the above-listed newly-cited references, render each of the newly-submitted claims 256-293 unpatentable.

1. U.S. Patent No. 5,930,445 to Peters et al.

As discussed above, the Peters patent incorporates by reference the application that matured into the Garmon patent, and both are assigned to Avid. The Peters patent is directed to an electronic film editing system in which video is digitized at 24 frames per second and edited in that format. The Avid system described in the Peters patent is based upon a personal computer. Video is compressed and stored in disk storage and then accessed for editing. The editing is non-linear because scenes can be selected at random from the disk storage for editing. The claims of the Peters patent specifically recite a system for non-linear editing.

2. U.S. Patent No. 3,617,626 to Bluth et al.

U.S. Patent No. 3,617,626 to Bluth et al. ("the Bluth patent") discloses a high-definition editing and recording system. A high definition camera 11 outputs R, B and G components, which are converted to digital by analog-to-digital converter 13 and recorded in digital form by a digital recorder 20. The camera is a high-definition electronic camera that operates at 1,575 lines per frame, 24 frames per second, non-interlaced. The system described in the Bluth patent provides a subsystem that can perform aspect ratio change (*e.g.*, from 2.35:1 to 1.33:1), scene compilation, and scan standards conversion (*e.g.*, for recording to 35 mm color film or converting to NTSC or PAL).

3. U.S. Patent No. 5,335,013 to Faber

U.S. Patent No. 5,335,013 to Faber ("the Faber patent") also discloses a progressive scan video camera operating at 24 frames per second which is converted into a digital format. Progressive scanning is employed in the Faber patent, and separate red, green and blue signal components are produced. Digital storage of the recorded signal is described.

4. Japanese Laid-Open Patent Application No. H04-37846

According to the translation of the first paragraph of its detailed description, Japanese Laid-Open Patent Application No. H04-37846 ("the JP '846 reference") "relates to a method of recording and reproducing images, and aims at making the creative operation process . . . related to movie production straightforward, accurate and faster . . . by means of matching with the movie film's standard reproducing speed of 24 frames per second, based on image capture, recording and edition [sic] by a video system of 24 frames per second." A copy of the JP '846 reference and an English translation thereof is attached hereto as Exhibit 5.

5. The MPEG-1 Standard

ISO/IEC 11172 (pts. 1 & 2) (1st ed. Aug. 1, 1993) ("the MPEG-1 standard") discloses compression, transmission and storage of digital audio and video signals.

6. The Van der Meer Article

A prior art article authored by Jan van der Meer of Philips Consumer Electronics entitled "The Full Motion System for CD-I," which appeared in the November 1992 edition of *IEEE Transactions on Consumer Electronics*, Vol. 38, No. 4 ("the Van der Meer article"), describes a CD-I (Compact Disc Interactive) system employing MPEG-1 compression.

7. Japanese Laid-Open Patent Application No. HEI 2-89478

Japanese Laid-Open Patent Application No. HEI 2-89478 (the "Canon" reference) discloses a digital video recorder employing compression.

C. Applicability of the Prior Art to Multi-Format's Newly-Submitted Claims 256-293

1. Claims 256-275

New reissue application claims 256-275 are directed to a method that includes performing non-linear editing on 24 frames per second digital video information and storing the

edited information. This is precisely what the prior art system developed by Avid does, as reflected in the several Avid references. More particularly, the system described in the Peters patent is a non-linear editing system used for editing 24 frames per second digital video. The concept of "non-linear editing" is simply that of providing random access to video data so that the various portions of the data can be accessed and edited in a sequential way, as described in the Reber patent. The system described in the Peters patent certainly performs such non-linear editing.

The Avid system described in the Peters patent stores the results of the editing. Specifically, the Garmon patent, which provides part of the Peters disclosure, discloses a function called "media consolidate" in which a user can select a set of clips in sequence and copy media data to a target disk. The target disk can also be removable. This feature is discussed at column 11, lines 37-51 of the Garmon patent. Thus, the system of the Peters patent receives digital video data having a frame rate of 24 frames per second, performs non-linear editing on the data, and stores the edited data. Claim 256 is thus anticipated by the Peters patent (which expressly incorporates the Garmon disclosure).

Even if the Peters and Garmon patents were to be viewed separately – rather than as a single reference as they should be given that Peters incorporate Garmon by reference – claim 256 would be obvious in view of the combination of these two Avid prior art references. Indeed, to the extent that the express incorporation by reference of the Garmon disclosure in the Peters patent does not form a single disclosure, it unquestionably provides the necessary motivation for combining the Peters and Garmon teachings. Moreover, the Reber patent and the Peters article are also directed to the same Avid system described in the Peters patent; therefore, it would have been readily obvious to combine the teachings of all of these Avid prior art references.

A claim chart illustrating how the Peters patent anticipates claim 256 is shown below (with Figure 1 from the Peters patent carrying over to the next page):

U.S. Patent Appl. No. 10/004,046	Avid U.S. Patent No. 5,930,445 to Peters et al. ('445) incorporating Avid U.S. Patent No. 5,355,450 to Garmon et al. ('450)
256. An audiovisual method, comprising:	
receiving video and audio information, wherein the video information embodies a digital format having a frame rate of substantially 24 fps;	Computer 18 receives 24 fps video from disc storage 32 ('445, Fig. 1) or 20 ('450, Fig. 1). "Disc storage 32 communicates with the computer to provide memory storage or digitized electronic image data. This disc storage may be optical, magnetic, or some other suitable media. The editing system is user-interfaced via a keyboard 34, or some other suitable user control interface. In operation, video and audio source material from a film which has been transferred to a videotape is received by the system via the video tape recorder 20, and is preprocessed and digitized by the audio A/D 22, audio processor 24, video A/D 26, and video compressor 30, before being stored in the disc storage 32." ('445, Col. 3, lines 30-41) "In operation, the video A/D 26 processes the video signal to reformat the signal so that the video represented by the signal corresponds to film speed, rather than videotape speed. The reformatted signal is then digitized, compressed, and stored in the computer for electronic film editing." ('445, Col. 6, lines 57-61) "At the completion of this digitization process, the editing system has a complete digital representation of the source film in film format, i.e., 24 fps[.]" ('445, Col. 7, lines 46-48) "Disk storage 20 includes one to seven disks for media storage. The disks may be optical or magnetic. The system 10 is controlled by a keyboard 22 and a mechanical user interface 24 to be described in more detail herein. In operation, video and audio source material is received by the system 10, digitized and stored in the disk storage device 20. The computer 18 is programmed so that the digitized source material may be edited and displayed on one of the video display devices such as the CRT display 12." ('450, Col. 2, lines 18-29)
performing non-linear editing on the video information in its digital format to create an edited version of the video information; and	"Once a film is input to the system, a film editor may electronically edit the film using the keyboard to make edit decision commands." ('445, Col. 3, lines 49-51) "A computer-based system for non-linear editing . . .." ('445, Claim 1) "As an example of an editing session, one scene could be selected from the bin and played on the source window 36 of the system CRT display 12. A film editor could designate frame points to be moved or cut in either timecode or film footage format. Correspondingly, audio points could be designated to be moved or the audio level increased (or decreased)." ('445, Col. 8, lines 38-44; *see generally* '445, Col. 8, lines 20-56) *See also* '450, Abstract.
storing the edited version of the video information on a high-capacity storage medium, wherein the edited version of the video information has a format embodying compressed digital video having a frame rate of substantially 24 fps.	"Another aspect of the invention is known as media consolidate. Media consolidate allows a user to select a set of clips in sequences and then copy media data from the media files referred to by that set into new media files on a target disk. A user would typically use this feature when he/she is done or almost done with a project and wants to free up most of his disk space but wants to be able to do more work at some later date without having to redigitize. By consolidating his media to a single disk, the remaining disks can be used for the next project. Of course, if the target disk is removable, all the drives in the media composer can be freed up. It is noted that the source media must be on line for media consolidate to work since it is not going back to the original tapes." ('450, col. 11, lines 37-48) Because the original video used in the editing process was originally in "a format embodying compressed digital video," the stored information resulting from the "media consolidate" steps likewise will be in compressed form.

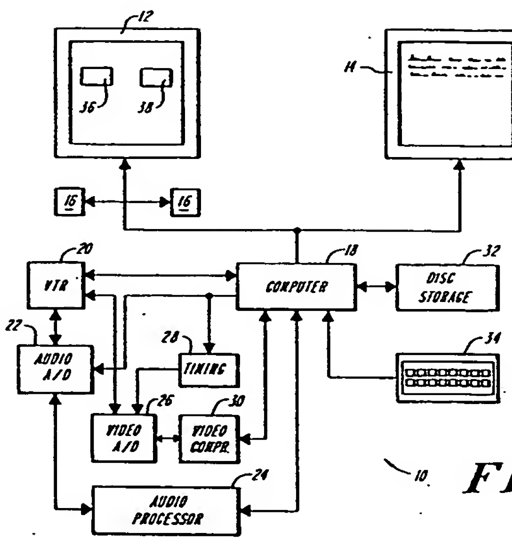

FIG. 1

The claims depending from independent claim 256 (reissue claims 257-274) are similarly unpatentable. For example, with respect to claim 257, the Avid system depicted in the Peters patent receives non-compressed, non-24 frames per second video data (*e.g.*, 29.97 frames per second NTSC video), digitizes it in the video A/D 26, and compresses it by means of the video compressor 30 as discussed in the following excerpt:

> In operation, video and audio source material from a film which has been transferred to a videotape is received by the system via the video tape recorder 20, and is preprocessed and digitized by the audio A/D 22, audio processor 24, video A/D 26, and video compressor 30, before being stored in the disc storage 32.

(Peters patent, Col. 3, lines 37-42.) The Peters patent describes this operation as follows:

> In operation, the video A/D 26 processes the video signal to reformat the signal so that the video represented by the signal corresponds to film speed, rather than videotape speed. The reformatted signal is then digitized, compressed, and stored in the computer for electronic film editing.

(Peters patent, Col. 6, lines 57-61.) The Peters patent then discusses what happens at the end of the digitization process:

> At the completion of this digitization process, the editing system has a complete digital representation of the source film in film format, i.e., 24 fps[.]

(Peters patent, Col. 7, lines 46-48.)

With respect to claim 258, the source of the received information in the Peters patent is film having a frame rate of 24 frames per second. With respect to claim 259, the component format is a standard format. In addition, the Peters article describing the Avid system specifically indicates that RGB or LUV encoding can be employed – both RGB and LUV are "component" formats.

Claim 260 recites that the video and audio information are received from the output of a video camera. Although the Peters patent discloses receiving video information from a videotape, it certainly would have been obvious to employ its editing system with a similar 24 frames per second video signal from another source such as a camera. 24 frames per second cameras were well known by the time of the alleged invention, as shown by each of the Bluth, Faber and JP '846 references. Each of these prior art references discloses use of a 24 frame-per-second video camera; it would have been obvious to provide the output of such a camera to a digital recording and editing system such as that disclosed in the Peters patent, because editing of camera outputs was commonplace (the videotapes used in the Peters patent originated with a camera). Indeed, both Bluth and the JP '846 reference are specifically directed to systems in which editing is also performed. As to the specific recitation of receiving both the video and the audio "from the output of a video camera," each of Bluth, Faber and JP '846 will necessarily provide audio corresponding to the video, because television and motion pictures provide sound. Whether the audio comes from a recorder which is part of the camera or a separate recorder synchronized with the camera is irrelevant to the processing performed in the recited method. Moreover, essentially every portable video camera has a microphone as well as an image pickup.

With respect to claims 261-263, as is the case with a video camera, the source of video information to be edited with the system of the Peters patent can be any standard source. It is also noted that the MPEG-1 standard discloses the use of 24 frames per second compressed video and the use of numerous different transmission mediums. *See, e.g.*, page 1 of Part 2 of the MPEG-1 standard. Multi-Format has effectively admitted that transmission of video by network, by satellite, and by conventional broadcasting were well known in the art. The '157 patent gives no details or instruction as to how these signals are received, or as to how to construct "an appropriate adapter unit 220 for the data network or 'information superhighway'" (U.S. Patent No. RE 38,079, Col. 13, lines 33-35) or a satellite receiver or broadcast receiver. If these transmission modes were not well known, reissue claims 261-263 would lack enablement. By presenting claims 261-263, Multi-Format has asserted that these transmission modes were known in the art. Thus, all of these transmission modes were art-recognized sources for video, and selection of any one known source hardly involves a patentable invention.

With respect to claim 264, the Peters patent specifically teaches manipulating the video-to-NTSC format and outputting the resulting signal for display (Col. 8, lines 44-56). Additionally, the Peters article discloses that the Avid system performs various image manipulations, such as those described at page 9 of the Peters article. The Bancroft article also clearly discloses the manipulation of a stored image into numerous different predetermined display formats, as illustrated in Figure 3 of that article. The Bluth patent also discloses conversion into numerous different formats, such as 35 mm color film, NTSC and PAL, as illustrated in Figure 1 of that prior art reference; and Bluth specifically discloses aspect ratio change at column 6, lines 42-61. It would have been obvious to employ such elements in the system of the Peters patent – if that system does not, in fact, already have such elements – since

in both cases video data stored in 24 frames per second format needs to be manipulated to provide different output display formats.

With respect to claim 266, the Peters patent uses a 3:2 pulldown conversion to form the NTSC output signal displayed (Col. 8, lines 44-56). As to claims 265 and 266, it would have been obvious to output an HDTV format and employ 3:2 pulldown in the Peters system. As recognized in the specification itself, 30 frames per second HDTV was already a known format (*see, e.g.*, Peters patent at Col. 12, line 38 and Col. 10, lines 36-40) and 3:2 pulldown is necessary to convert 24 frames per second signals to 30 frames per second signals. Even if it is determined that such operations are not anticipated or obvious in view of the Peters patent by itself, they certainly are so in view of the Bancroft article, which discloses conversion to numerous formats, and the Bluth patent, which teaches that the signal can be converted "for use according to one or more of several television standards." (Bluth patent, Col. 9, lines 31-33.)

With respect to claim 267, the Peters patent employs a general purpose computer. With respect to claims 268-275, page 9 of the Peters article describes performing such standard operations. Normal image manipulations, such as squeeze and pan, are specifically described in the Peters article.

Independent claim 256 is additionally unpatentable over the Bluth patent, either alone or in combination with any of numerous prior art references showing the use of compression (such as the MPEG-1 standard or the Peters patent). The Bluth patent discloses a camera 11 and A-to-D converters that provide a digital input signal recorded by digital recorder 20, a subsystem including incremental recorders 50-52, assembler 42 for performing non-linear editing, and a master recorder 58 for storing the edited video. The assembler 42 selects various picture frames

according to addresses from the incremental recorders to perform non-linear editing and records the resulting data on the master recorder 58.

The correspondence of the Bluth patent to claim 256 is illustrated in detail in the claim chart set forth below (with Figure 1 from the Bluth patent carrying over to the next page):

U.S. Patent Appl. No. 10/004,046	U.S. Patent No. 3,617,626 to Bluth et al.
256. An audiovisual method, comprising:	
receiving video and audio information, wherein the video information embodies a digital format having a frame rate of substantially 24 fps;	"This invention relates to an electronic system for achieving high-definition color motion pictures for theatrical and television use, and more particularly to a system of this nature employing digital video techniques. " (Col. 1, lines 5-8) "A high-definition electronic camera 11 is provided which operates at a scan standard of approximately 1575 lines per frame, 24 frames per second, noninterlaced." (Col. 3, lines 31-34) "The red, blue and green analog video outputs from the camera control 12 (or from the electronic switching system noted above, if used) are converted to digital form by analog-to-digital converters 13, one converter being used for each color." (Col. 4, lines 6-10) "The output digital signals from the converters 13 are applied to a digital recorder 20 where each respective color signal is separately and simultaneously recorded longitudinally on magnetic tape." (Col. 4, lines 44-47)
performing non-linear editing on the video information in its digital format to create an edited version of the video information; and	"Master tapes which may be copies of the entire tape recorded by the digital recorder, or portions thereof, are placed on one or more incremental recorders which in turn allow any number of frames or scenes of the recorded motion picture to be selected at will. This is done to enable various frames and scenes, as well as special effects, to be assembled into a final master color motion picture." (Col. 2, lines 55-62) "The recorded information from the digital recorder 20 may be operated upon, modified and assembled as briefly noted above by means of a subsystem including three incremental recorders 50 through 52, the assembler 42, an assembler control 53, punched-tape reader 54, special effects generator 55, member control 56, and a recirculating loop member 57 similar to the memory 24 described above. The incremental recorders 50 through 52 are of the type used to record and play back computer data. Information concerning the makeup or compilation of the motion picture as decided upon by the editor according to his asthetic taste is stored on paper tape which in turn can be played back by the punched-tape reader 54. The information from the punched tape allows the assembler 42 to search out the various picture frames according to address from the incremental recorders, select the desired sequences and record the resulting data on a master recorder 58." (Col. 7, lines 1-17) "Although three incremental recorders 50 through 52 are illustrated, any number as desired may be employed depending upon how many sequences there may be, or the various combinations and permutations of portions of sequences, to be assembled. The assembler then controls the operation of each incremental recorder, and selects the various program scenes and frames as needed for the final assembled motion picture." (Col. 7, lines 43-49)
storing the edited version of the video information on a high-capacity storage medium, wherein the edited version of the video information has a format embodying compressed digital video having a frame rate of substantially 24 fps.	"The frame identification data enables playback of desired frames and scenes by the incremental recorders 50 through 52 in proper sequence and time as determined by the assembler 42. It will be apparent that this then is a sequential assembly subsystem which searches for the particular desired scene or frame existing in one of the three incremental recorders and, in turn, extracts that scene or frame and records the same on the master digital recorder 58." (Col. 7, lines 35-42) Thus, the "master digital recorder 58 holds the "edited version" of the video. Use of compression is obvious. (*See, e.g.*, MPEG-1 standard ("This part of ISO/IEC 11172 was developed in response to industry needs for an efficient way of storing and retrieving audio and video information on digital storage media (DSM).") and the Peters patent.) Indeed, the Canon reference uses "image compressing means for compressing image data on the basis of characteristics of the image data" (translation, p.6; 12, Fig .1) in the exact same environment—a digital video recorder for holding a high-resolution 24 fps video image.

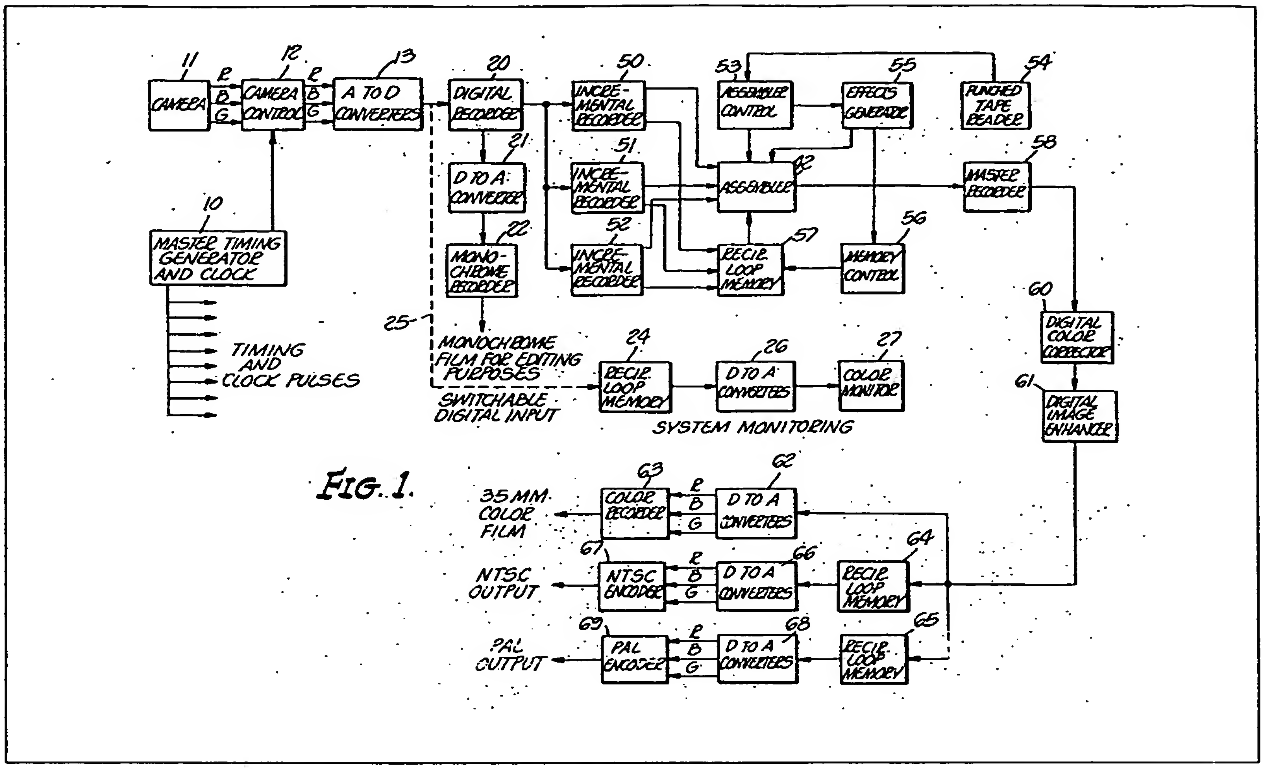

FIG. 1.

Dependent claims 257-274 are similarly unpatentable over the Bluth patent, either alone or in combination with the various references discussed above. The Bluth patent specifically discloses that the video information is embodied in a component format, namely RGB, as recited in claim 259. Bluth also discloses that the information is received from the output of a video camera as set forth in claim 260. In this regard, claims 256 and 260 do not require performance of any manipulative step with audio information beyond "receiving" it; these claims thus read directly on a system in which the edited and stored video is devoid of audio. Further, although the Bluth patent does not specifically discuss audio, this system will naturally provide audio recording too since motion pictures and television employ audio; it is a universal practice to edit and compress audio along with video. *See, e.g.*, the Peters patent (editing); the MPEG-1 standard (compression); and the Canon reference (compression).

Numerous manipulations are performed in the Bluth patent to provide different display outputs as recited in claim 264. In addition, the stored video data in the master recorder 58 is

high definition and is therefore an HDTV format. Moreover, image processing to provide an NTSC output would include performing 3:2 pulldown. As noted above, the Bluth patent contains specific discussion regarding resizing the image aspect ratio, which, in the disclosed embodiment, is done by cropping. Finally, the Bluth patent also discloses outputting to a film recording unit as recited in new claim 275.

Claim 256 and numerous dependent claims are also anticipated by the Bancroft article. This article describes performing editing and processing of 24 frames per second digital video signals and subsequent conversion to numerous different outputs.

The applicability of the Bancroft prior art reference to claim 256 is illustrated in the claim chart on the following page (which includes Figure 3 from the Bancroft article):

U.S. Patent Appl. No. 10/004,046	Bancroft, "Pixels and Halide – A Natural Partnership?", *SMPTE Journal*, pp. 306-311 (May 1994)
256. An audiovisual method, comprising:	
receiving video and audio information, wherein the video information embodies a digital format having a frame rate of substantially 24 fps;	"Figure 3 shows the basic concept – coming out of the telecine is an 'electronic representation' of the film. An electronic representation means several things: Preserving the film's temporal sampling characteristics. A typical film camera can be thought of as capturing all the picture elements of the visual image simultaneously in one exposure at the rate of 24 exposures/sec. To represent this faithfully in a video signal we should ideally use a progressive scan 24 frame/sec scheme. Preserving the film's spatial characteristics sufficiently for the highest distribution standard needed. To satisfy the most demanding video output formats – HDTV formats – an 'HDTV' order of magnitude of pixels and scan lines should be used. An HDTV video distribution derived from film in this way should certainly have no less spatial resolution than the HDTV output format allows." (p. 307) Note that use of pixels means that the information is digital.
performing non-linear editing on the video information in its digital format to create an edited version of the video information; and	"This electronic representation would then travel through color correction, grain and dirt-effect reduction, image stabilization and (possibly) editing, just once, to the important-looking box at the end – the output format converter." (p. 307)
storing the edited version of the video information on a high-capacity storage medium, wherein the edited version of the video information has a format embodying compressed digital video having a frame rate of substantially 24 fps.	"This box is the point at which a switch is thrown to decide which video distribution format is to be selected, according to which particular market the entertainment product is being sold. What's in this box? Well, perhaps not surprisingly, some of the familiar processes that might have been in the telecine are in there, such as 3/2 pull-down circuitry, pan and scan or letter-boxing, with de-anamorphing of images such as CinemaScope, if desired. The important point is that none of these things were locked in, in advance, coming out of the telecine. If the transfer that came out then was truly generic to all these various output permutations, then all of them can be derived from the one electronic archive copy. This archive copy might be called an 'electronic inter-positive.'" (p. 307)

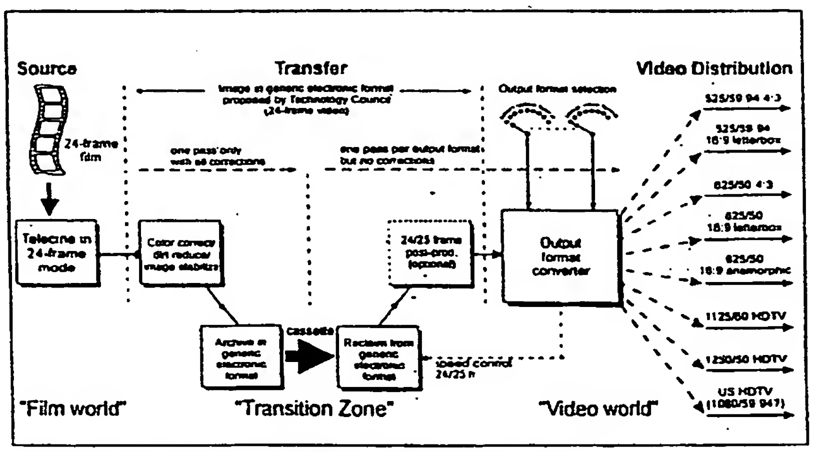

Figure 3. Technology Council proposal: "generic transfer process."

The Bancroft article additionally describes many of the limitations set forth in the claims dependent from claim 256, including 3:2 pulldown, pan and scan or letterboxing, anamorphing, etc.

2. Claims 276-284

New independent claim 276 is directed to a system that includes a video camera for capturing digital video information at a frame rate of substantially 24 frames per second and a digital video recorder for recording the digital video information at a frame rate of substantially 24 frames per second. The Bluth patent clearly anticipates claim 276 as it discloses video camera 11 which captures video at 24 frames per second and digitizes it by A-to-D converter 13, and further discloses digital recorder 20 which records the captured digital video.

The anticipation of claim 276 by the Bluth patent is demonstrated in the claim chart on the following page (which includes Figure 1 from the Bluth patent):

U.S. Patent Appl. No. 10/004,046	U.S. Patent No. 3,617,626 to Bluth et al.
276. A system for capturing and recording digital video information, comprising:	
a video camera for capturing digital video information at a frame rate of substantially 24 frames per second; and	"A high-definition electronic camera 11 is provided which operates at a scan standard of approximately 1575 lines per frame, 24 frames per second, noninterlaced." (Col. 3, lines 31-34) "The red, blue and green analog video outputs from the camera control 12 (or from the electronic switching system noted above, if used) or converted to digital form by analog-to-digital converters 13, one converter being used for each color." (Col. 4, lines 6-10)
a digital video recorder in communication with the graphics processor[5] for recording the digital video information at a frame rate of substantially 24 fps.	"The output digital signals from the converters 13 are applied to a digital recorder 20 where each respective color signal is separately and simultaneously recorded longitudinally on magnetic tape." (Col. 4, lines 44-47)

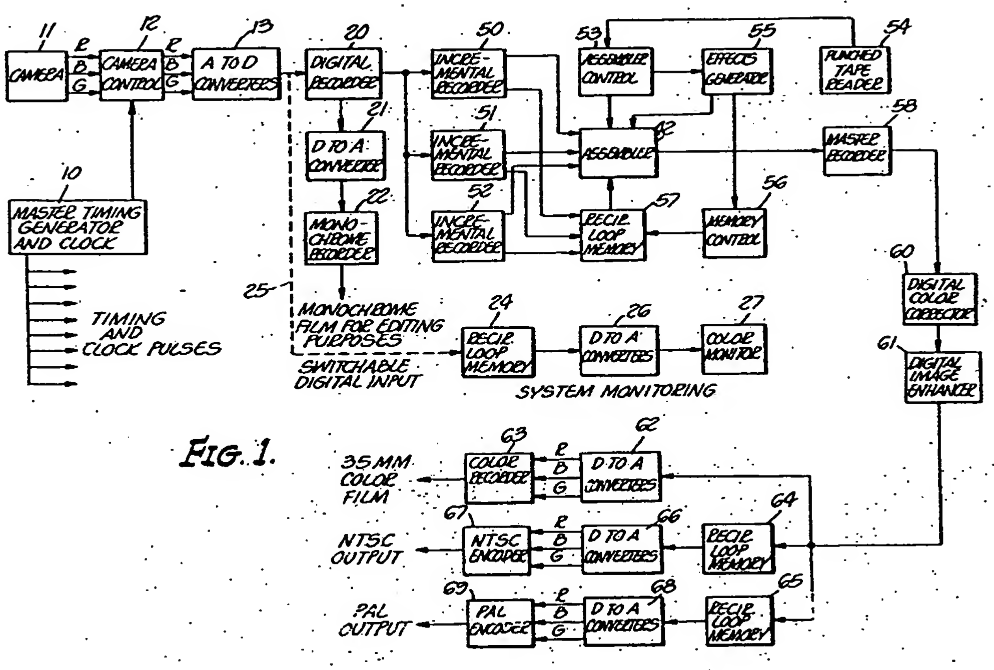

FIG. 1.

[5] The expression "in communication with the graphics processor" in claim 276 has no antecedent basis because no "graphics processor" is previously recited in the claim; therefore, reissue claim 276 should be rejected under 35 U.S.C. § 112, ¶ 2.

Independent claim 276 is also unpatentable over the JP '846 reference. The first page of the translation of this Japanese prior art publication (*see* Exhibit 5 hereto) states that it performs "image capture, recording and addition by a video system of 24 frames per second." On page 2 of the translation, the "method of video of 24 frames per second" is outlined and the reference indicates that it is directed to the "new conception, remodeling of standard generation for video cameras." The JP '846 reference also notes the requirement of "remodeling of video-recorder's recording/reproducing circuit."

Thus, the JP '846 reference clearly discloses image capture at 24 frames per second and image recording at 24 frames per second. Although the JP '846 reference does not identify whether analog or digital capture and recording is employed, it certainly would have been obvious to employ either well-known type of recording with the 24 frames per second method disclosed in the JP '846 reference.

Independent claim 276 is also anticipated by the Faber patent. As discussed above, the Faber patent discloses a progressive scan camera 110 which operates at 24 frames per second, and an analog-to-digital converter 114 for converting the output of the camera into a digital output. Faber then discloses processing to add grain and modify gray scale and subsequent conversion from progressive to interlace in scan converter 128, so as to form a "digital video output 130 in a 625 lines/48 fields format" (*i.e.*, 24 frames per second interlaced), which is "input directly to a digital video tape recorder 131" (Col. 5, lines 16-27).

The anticipation of claim 276 by the Faber patent is demonstrated in the claim chart on the following page (which includes the corrected Figure 1 of the Faber patent from a Certificate of Correction):

U.S. Patent Appl. No. 10/004,046	U.S. Patent No. 5,335,013 to Faber
276. A system for capturing and recording digital video information, comprising:	
a video camera for capturing digital video information at a frame rate of substantially 24 frames per second; and	An image 102 is focused by a lens 104 onto an imager 106. The imager is typically a solid state charge-coupled device (CCD). However, other imaging devices, such as a pickup tube, may be used. The synchronization and timing controller 108 controls the scanning, timing and outputting of the image signal 110 from the imager 106. The image signal 110 is preferably a progressively-scanned video frame. In comparison, a conventional broadcast television camera generates two consecutive interlaced fields. Furthermore, 24 frames-per-second of the image signal are generated to simulate the frame rate of a motion picture camera. (Col. 4, lines 16-27)
a digital video recorder in communication with the graphics processor for recording the digital video information at a frame rate of substantially 24 fps.	This modified video image is in a 24 progressively-scanned frames-per-second format where each frame consists of 625 lines. The image is now converted to a conventional video format. The image could also be converted to other video formats as desired. For conversion into a 625 lines/48 fields format, the modified video image 126 is inputted into a progressive-to-interlace scan converter 128. The scan converter 128 generates two interlaced fields of 312 and 313 lines each consecutively from the 625 line progressively-scanned frame. The conversion is done in the embodiment shown by storing the video image in a memory, and reading out every other line for the first field and reading the other lines for the second field. The video image is now represented in 48 fields-per-second, each field having 312 or 313 lines. The digital video output 130 in a 625 lines/48 fields format is input directly into a digital video tape recorder 131. (Col. 5, lines 16-28)

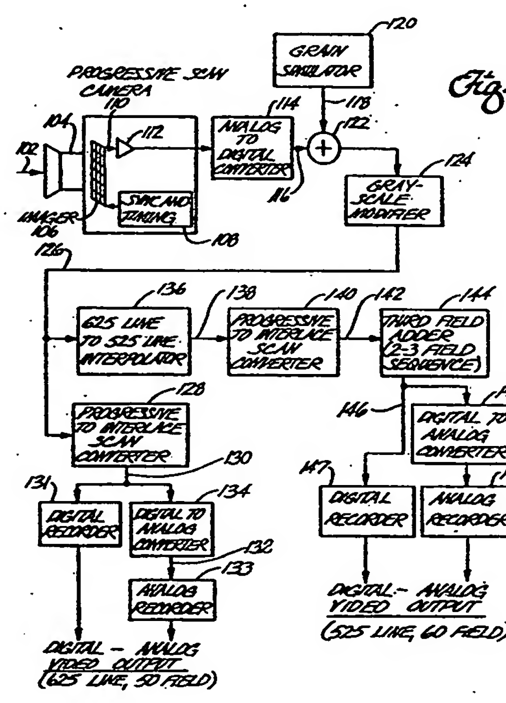

Fig. 1

Dependent claims 277-284 are also unpatentable in view of the prior art references raised herein. With respect to claim 277, Faber teaches a graphics processor including a "grain simulator" 120, summer 122, and "gray scale modifier" 124, which operate on the digital image.

As to claims 277 and 281-284, the Bluth patent includes a processor for performing image manipulation including resizing the image aspect ratio by cropping. Bluth also employs an HDTV format. It would have been obvious to resize by performing a non-linear transformation such as squeezing since this was a standard technique as illustrated in the Peters article about the Avid system. With respect to claims 278-279, whether the digital recorder is employed in the video camera or separate from the video camera is a mere choice from among known, art-recognized alternatives. The integrated digital recorder and camera is so commonplace that there is an English word for it ("camcorder") and an entire subclass (358/906) full of art devoted to it. The use of an optical disk drive for the recorder (claim 280) is likewise notorious in the art. For example, it is specifically contemplated in the MPEG-1 standard and the Van der Meer article.

Claims 281-284 are also unpatentable over either the Bluth patent or the Faber patent in view of the Bancroft article. Bancroft discloses performing image manipulation as set forth in these dependent claims.

3. Claims 285-293

Independent method claim 285 is also unpatentable over either the Bluth or Faber patents for the same reasons given above with respect to independent apparatus claim 276.

The anticipation of claim 285 by the Bluth patent is shown in the claim chart on the next page (which includes Figure 1 of the Bluth patent):

U.S. Patent Appl. No. 10/004,046	U.S. Patent No. 3,617,626 to Bluth et al.
285. A method of capturing and storing digital video information, comprising:	
capturing digital video information at a frame rate of substantially 24 frames per second; and	"A high-definition electronic camera 11 is provided which operates at a scan standard of approximately 1575 lines per frame, 24 frames per second, noninterlaced." (Col. 3, lines 31-34) "The red, blue and green analog video outputs from the camera control 12 (or from the electronic switching system noted above, if used) or converted to digital form by analog-to-digital converters 13, one converter being used for each color." (Col. 4, lines 6-10)
recording the digital video information in a format having a frame rate of substantially 24 frames per second.	"The output digital signals from the converters 13 are applied to a digital recorder 20 where each respective color signal is separately and simultaneously recorded longitudinally on magnetic tape." (Col. 4, lines 44-47)

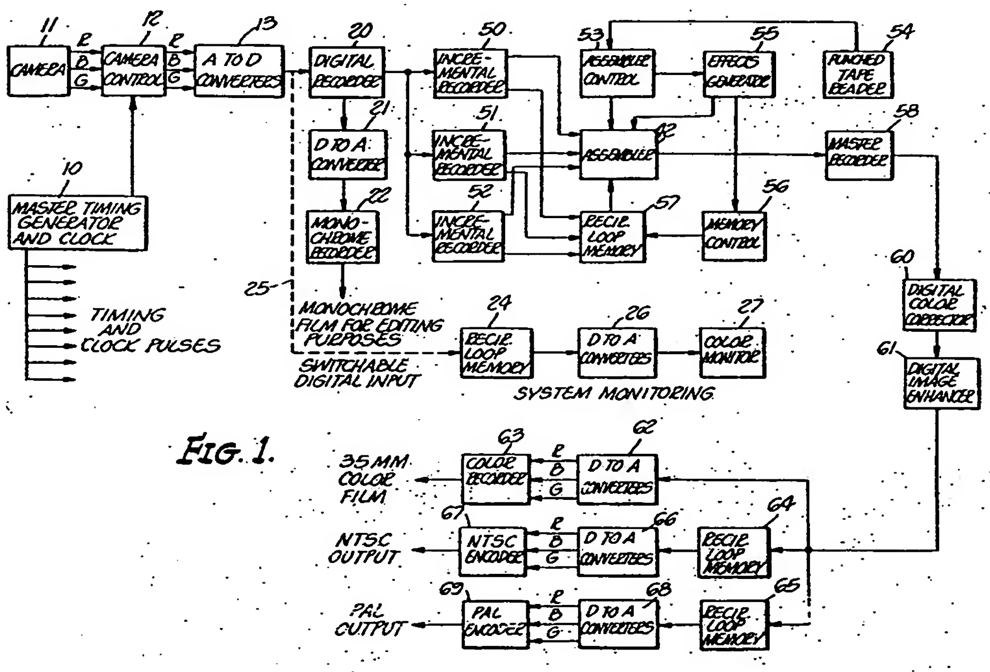

FIG. 1.

The anticipation of claim 285 by the Faber patent is shown in the below claim chart (which includes the corrected Figure 1 of the Faber patent):

U.S. Patent Appl. No. 10/004,046	U.S. Patent No. 5,335,013 to Faber
285. A method of capturing and storing digital video information, comprising:	
capturing digital video information at a frame rate of substantially 24 frames per second; and	An image 102 is focused by a lens 104 onto an imager 106. The imager is typically a solid state charge-coupled device (CCD). However, other imaging devices, such as a pickup tube, may be used. The synchronization and timing controller 108 controls the scanning, timing and outputting of the image signal 110 from the imager 106. The image signal 110 is preferably a progressively-scanned video frame. In comparison, a conventional broadcast television camera generates two consecutive interlaced fields. Furthermore, 24 frames-per-second of the image signal are generated to simulate the frame rate of a motion picture camera. (Col. 4, lines 16-27)
recording the digital video information in a format having a frame rate of substantially 24 frames per second.	This modified video image is in a 24 progressively-scanned frames-per-second format where each frame consists of 625 lines. The image is now converted to a conventional video format. The image could also be converted to other video formats as desired. For conversion into a 625 lines/48 fields format, the modified video image 126 is inputted into a progressive-to-interlace scan converter 128. The scan converter 128 generates two interlaced fields of 312 and 313 lines each consecutively from the 625 line progressively-scanned frame. The conversion is done in the embodiment shown by storing the video image in a memory, and reading out every other line for the first field and reading the other lines for the second field. The video image is now represented in 48 fields-per-second, each field having 312 or 313 lines. The digital video output 130 in a 625 lines/48 fields format is input directly into a digital video tape recorder 131. (Col. 5, lines 16-28)

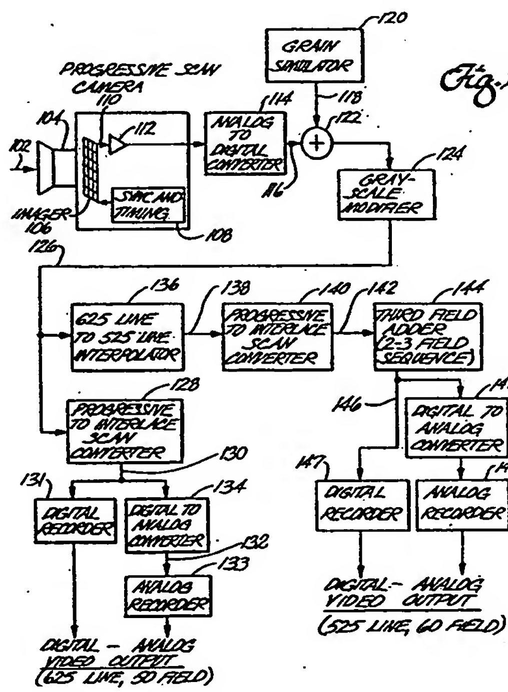

Fig.1

Finally, dependent claims 286-293 are similarly unpatentable over the prior art for the reasons given above.

V. SUMMARY AND CONCLUSION

In summary, the Protestors submit that all of the claims that are currently pending in Reissue Application Ser. No. 10/004,046 are unpatentable for numerous reasons. As detailed above, applicant Multi-Format is precluded under the doctrine of restriction acquiescence from obtaining claims 256-293, as those claims are directed to subcombinations that are wholly distinct from the subcombination that was elected during the prosecution of the original '157 patent. Multi-Format is also barred from obtaining claims 256-293 due to recapture estoppel because those claims omit a limitation that was relied upon in an effort to obtain allowance of the claims of the '157 patent and thereby impermissibly seek to recapture surrendered subject matter. In addition, claims 256-274 are unpatentable for failing to satisfy the written description requirement of 35 U.S.C. § 112, ¶ 1, while all of the pending claims 256-293 are unpatentable over various prior art references, taken singly or in combination. In view of the above, new claims 256-293 should be rejected.

The Patent Office is authorized to charge the cost, if any, of this Protest and/or other fees due in connection with the filing of this document to **Deposit Account No. 03-1952** referencing 16716-0000006.

Dated: April 15, 2005

Respectfully submitted:

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ALTERNATIVE TO PTO/SB/08a/b (06-03)

Substitute for form 1449/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	10/004,046
(Use as many sheets as necessary)	Filing Date	October 24, 2001
	First Named Inventor	WASHINO et al.
	Art Unit	2614
	Examiner Name	D. Harvey
Sheet 1 of 1	Attorney Docket Number	167160000006

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1.	5,267,351	11/30/1993	S. Reber et al.	
	2.	5,355,450	10/11/1994	P. Garmon et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	3.	JP 04-37846 A	02/07/1992	Hiyama Shigeo		X

*EXAMINER: Initial if information considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	4.	Peters, Eric C., "A Real Time, Object Oriented, Non-Linear Editing System For Film And Video", SOCIETY OF MOTION PICTURE AND TELEVISION ENGINEERS, INC., 131st SMPTE Technical Conference, October 21-25, 1989, Los Angeles, CA, preprint no. 131-91	
	5.	Bancroft, David J., "Pixels and Halide-A Natural Partnership?", SMPTE Journal, May 1994, pp 306-311	

*EXAMINER: Initial if information considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1]Applicant's unique citation designation number (optional). [2]Applicant is to place a check mark here if English language Translation is attached.

Examiner Signature		Date Considered	

la-787806

EXHIBITS TO PROTEST RELATING TO NEW CLAIMS UNDER 37 C.F.R. § 1.291(c)
In re Reissue Patent Appl. No. 10/004,046

Exhibit 1: U.S. Patent No. 5,355,450 to Garmon et al. ("the Garmon patent").

Exhibit 2: U.S. Patent No. 5,267,351 to Reber et al. ("the Reber patent").

Exhibit 3: Eric C. Peters, "Real Time, Object Oriented, Non-Linear Editing System for Film and Video," presented at 131st SMPTE Technical Conference, Los Angeles, California, Oct. 21-25, 1989, preprint No. 131-91 ("the Peters article").

Exhibit 4: David J. Bancroft, "Pixels and Halide – A Natural Partnership?," *SMPTE Journal*, pp. 306-311 (May 1994) ("the Bancroft article").

Exhibit 5: Japanese Laid-Open Patent Application No. H04-37846, accompanied by English translation ("JP '846 reference").

US005355450A

United States Patent [19]

Garmon et al.

[11] Patent Number: 5,355,450

[45] Date of Patent: Oct. 11, 1994

[54] MEDIA COMPOSER WITH ADJUSTABLE SOURCE MATERIAL COMPRESSION

[75] Inventors: Paul D. Garmon, Winchester; Robert A. Gonsalves, Brighton; Patrick D. O'Connor, Framingham, all of Mass.; Stephen J. Reber, Nashua, N.H.; Eric C. Peters, Carlisle; Joseph H. Rice, Arlington, both of Mass.; Curt A. Rawley, Windham, N.H.

[73] Assignee: Avid Technology, Inc., Tewskbury, Mass.

[21] Appl. No.: 866,829

[22] Filed: Apr. 10, 1992

[51] Int. Cl.[5] G06F 15/62

[52] U.S. Cl. 395/162; 348/578; 348/579; 348/384; 348/722

[58] Field of Search 395/162, 154, 114; 358/22, 181, 182, 183, 185, 133-136

[56] References Cited

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WO91/14339	9/1991	World Int. Prop. O. .

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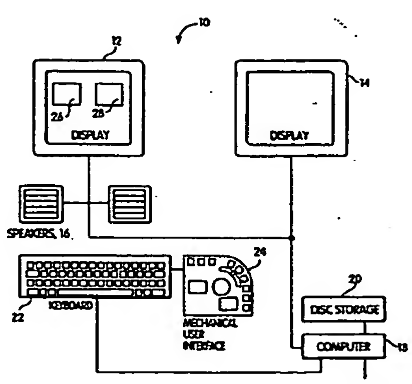
Primary Examiner—Robert L. Richardson
Attorney, Agent, or Firm—Wolf, Greenfield & Sacks

[57] ABSTRACT

Media composer for editing source material. The media composer includes apparatus for receiving digitizing, storing and editing video and audio source material. Computing apparatus manipulates the stored source material and output apparatus communicates with the computing apparatus to display the manipulated material and control information. The computing apparatus includes JPEG compression techniques and is programmed to provide enhanced editing features.

20 Claims, 7 Drawing Sheets



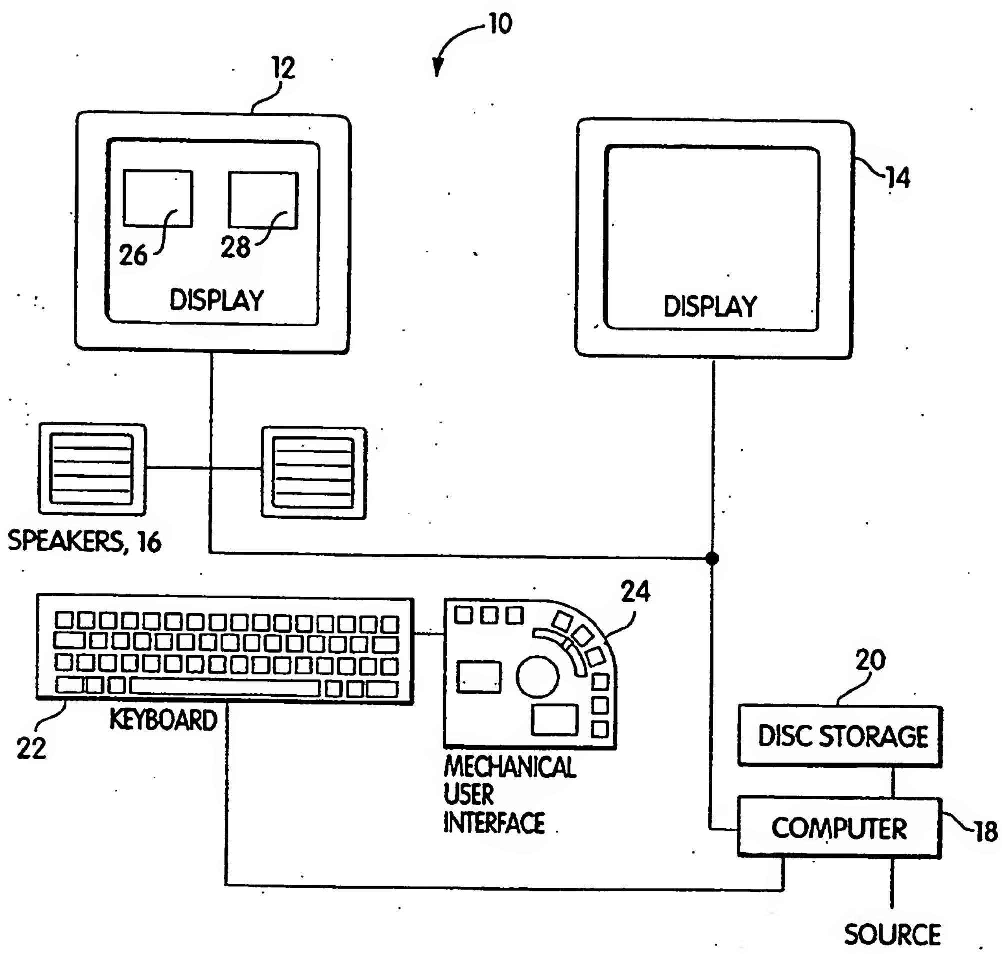

10
12
26
28
DISPLAY
DISPLAY
14
SPEAKERS, 16
24
KEYBOARD
22
MECHANICAL
USER
INTERFACE
20
DISC STORAGE
COMPUTER
18
SOURCE

Fig. 1

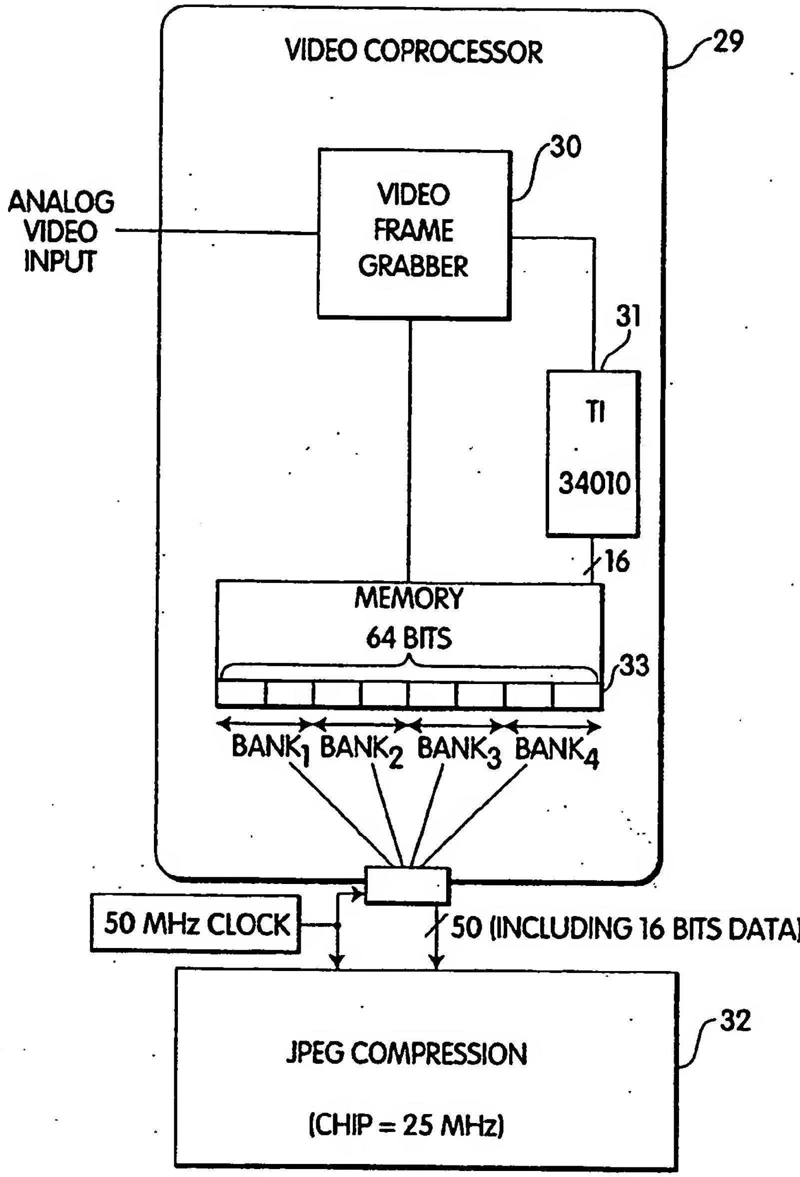


Fig. 2A
(Prior Art)

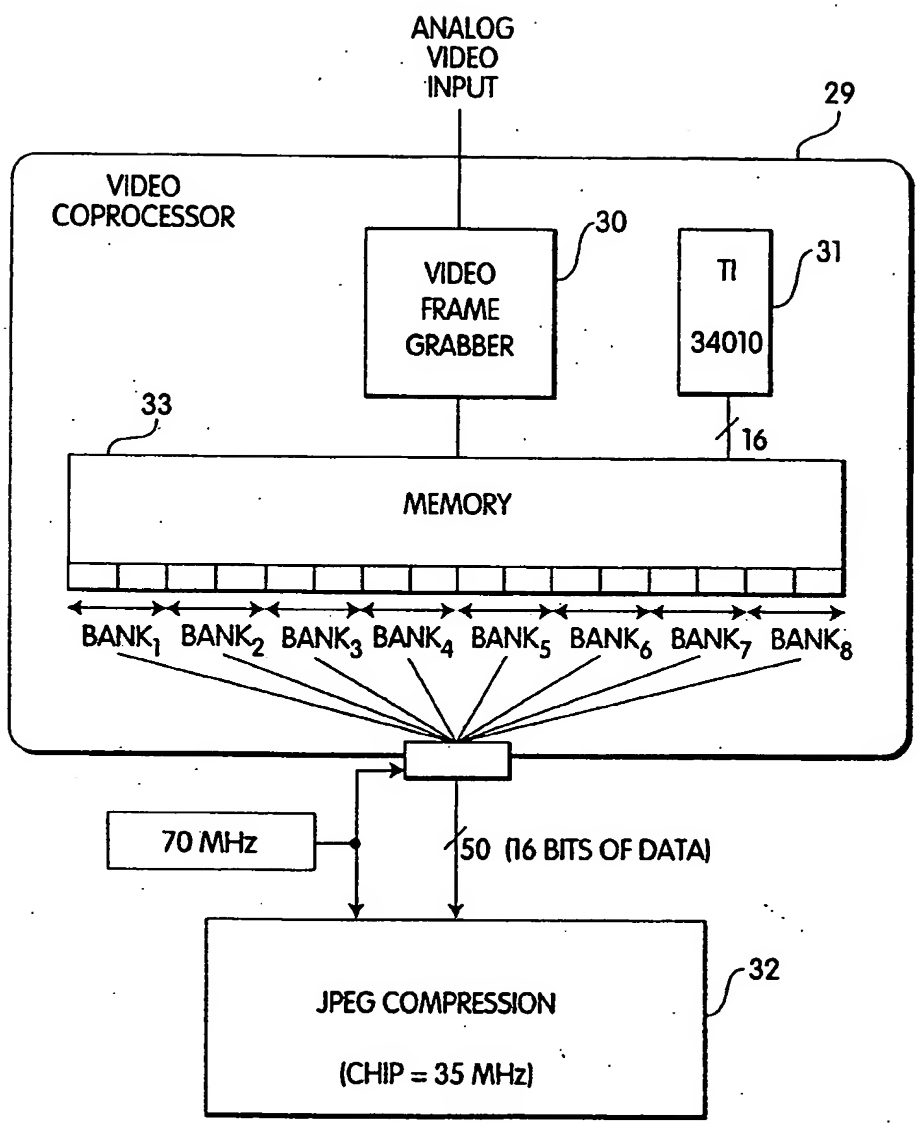

ANALOG VIDEO INPUT
29
VIDEO COPROCESSOR
30
VIDEO FRAME GRABBER
TI 34010
31
33
16
MEMORY
BANK$_1$ BANK$_2$ BANK$_3$ BANK$_4$ BANK$_5$ BANK$_6$ BANK$_7$ BANK$_8$
70 MHz
50 (16 BITS OF DATA)
JPEG COMPRESSION
(CHIP = 35 MHz)
32

Fig. 2B

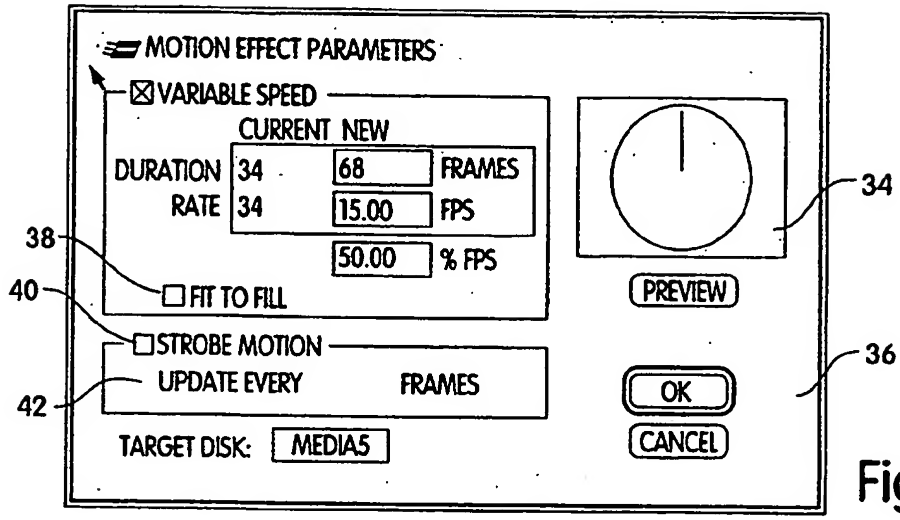


Fig. 3

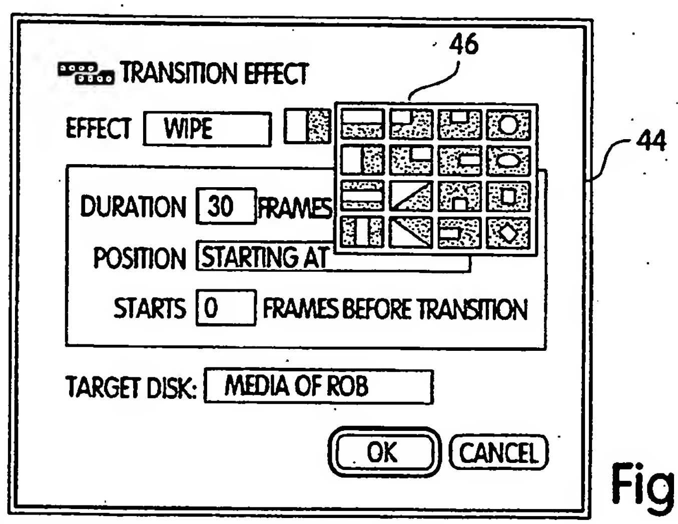


Fig. 4A

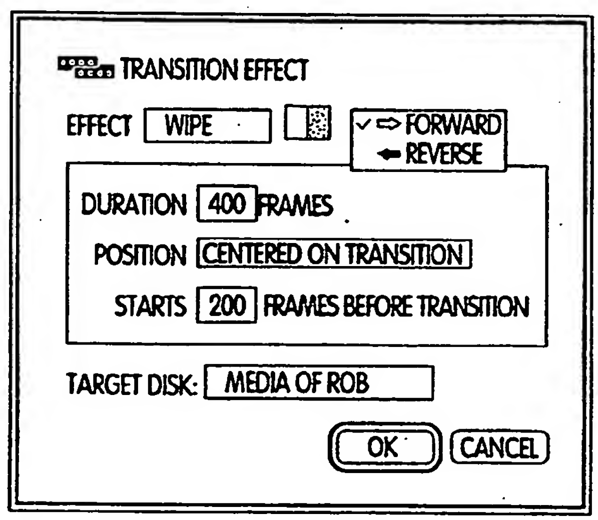
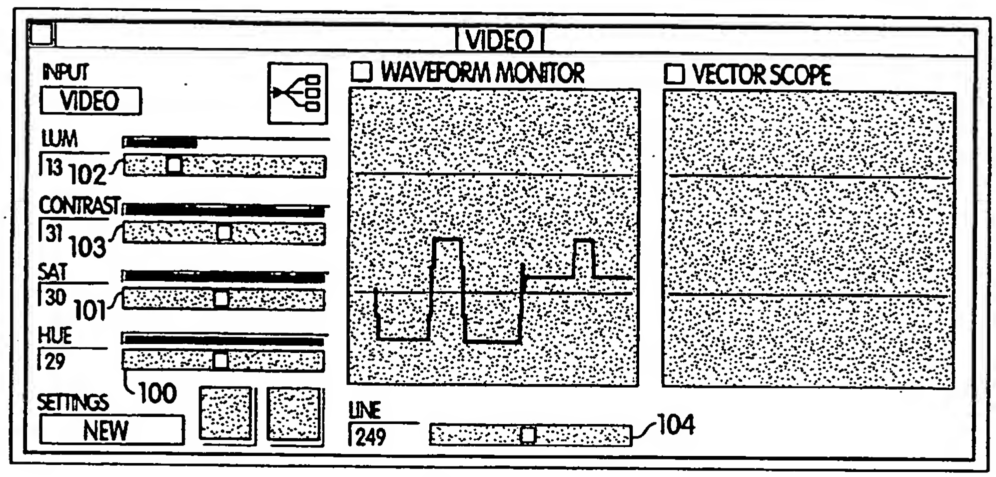


Fig. 4B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INPUT
VIDEO
WAVEFORM MONITOR
VECTOR SCOPE
LUM
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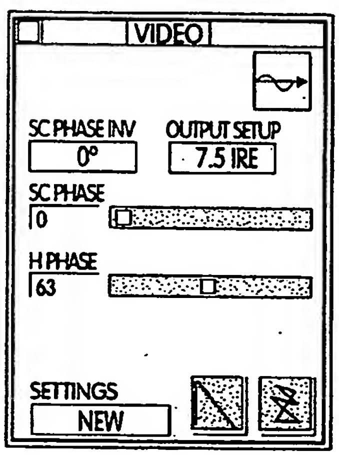
102
CONTRAST
31
103
SAT
30
101
HUE
29
100
SETTINGS
NEW
LINE
249
104

Fig. 5A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OUTPUT SETUP
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H PHASE
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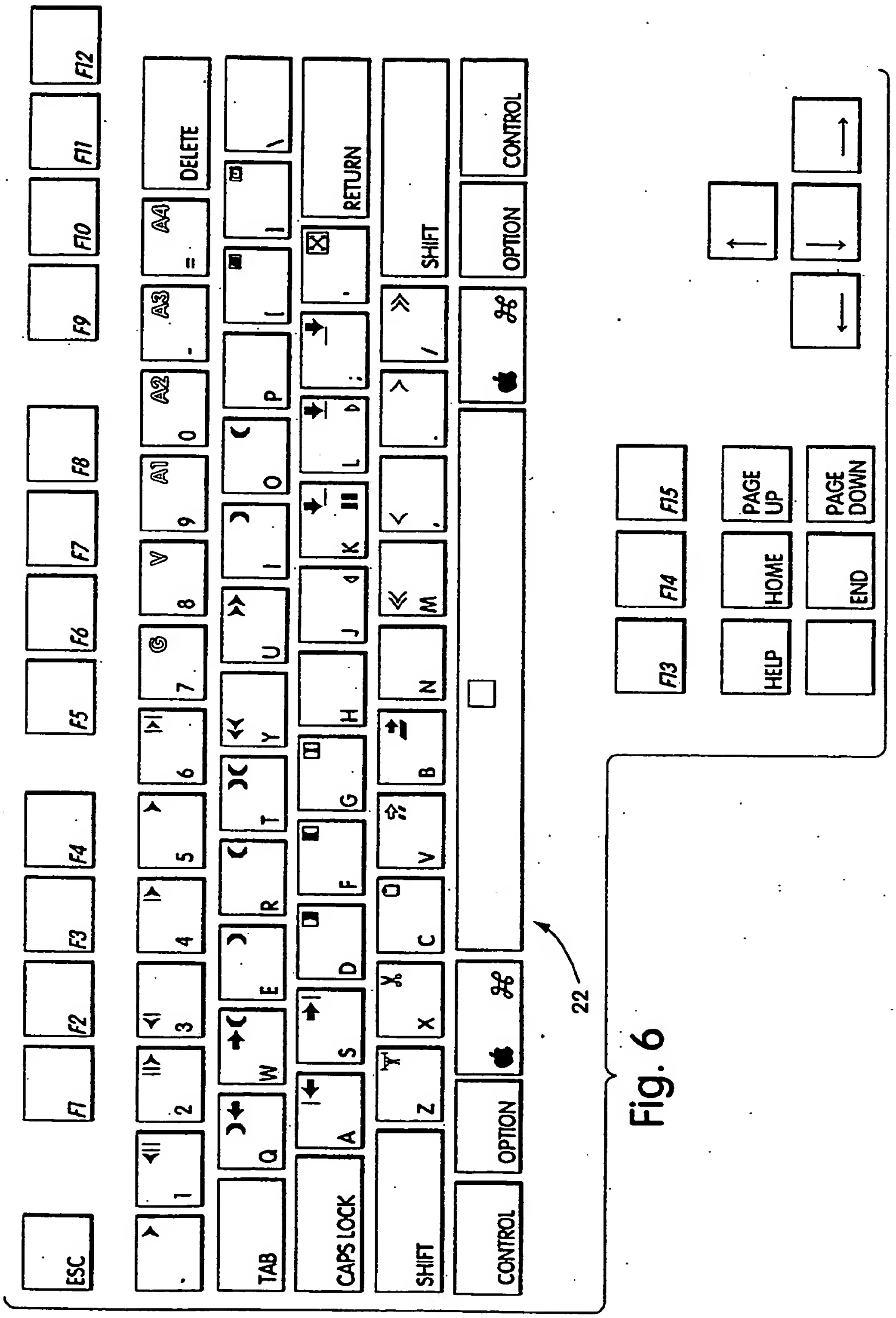
SETTINGS
NEW

Fig. 5B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F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
A1
A2
A3
A4
DELETE
TAB
CAPS LOCK
RETURN
SHIFT
SHIFT
CONTROL
OPTION
OPTION
CONTROL
F13
F14
F15
HELP
HOME
PAGE UP
END
PAGE DOWN
22

Fig. 6

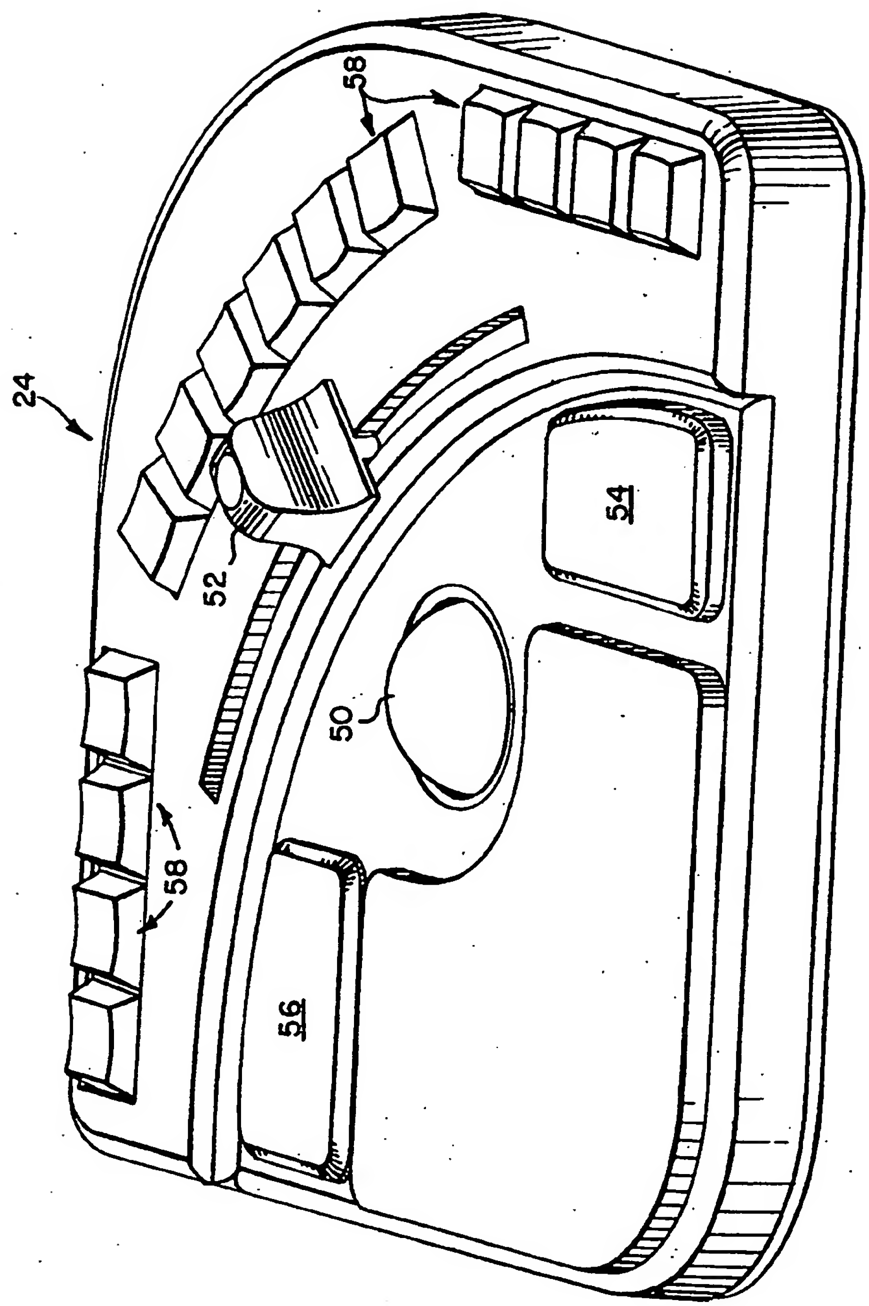

Fig. 7

MEDIA COMPOSER WITH ADJUSTABLE SOURCE MATERIAL COMPRESSION

BACKGROUND OF THE INVENTION

Video and audio source material editing systems employing digital techniques have been introduced over the last several years. One example is the Avid/1 Media Composer from Avid Technology, Inc., of Burlington, Mass. This media composer receives, digitizes, stores and edits video and audio source material. After the source material is digitized and stored, a computer such as an Apple Macintosh based computer manipulates the stored digital material and a pair of CRT monitors are used for displaying manipulated material and control information to allow editing to be performed. Later versions of the media composer included compression techniques to permit the display of full motion video from the digitized source material. Compression was achieved using a JPEG chip from C-Cube of Milpitas, Calif. That data compression is described more fully in copending application U.S. Ser. No. 07/807,269 filed Dec. 13, 1991, and entitled Buffer and Frame Indexing. The teachings of this application are incorporated herein by reference. Although previous media composers could achieve full motion video from digitized sources, the compression degraded image quality below desirable levels. Further, the media composer lacked features which enhance the editing process.

SUMMARY OF THE INVENTION

The media composer according to the invention for editing source material includes apparatus for receiving, digitizing, storing and editing video and audio source material. Computing apparatus manipulates the stored source material and output apparatus communicates with the computing apparatus for displaying the manipulated material and control information. The computing apparatus includes JPEG compression apparatus and is programmed so that multiple JPEG resolutions can be displayed, recorded and played back.

In another aspect of the invention, the computing apparatus is programmed to provide motion effects in the displayed material and is further programmed to provide a dial whose rotation rate corresponds to a selected motion effect rate. Motion effects include forward and reverse variable speed effects, fit-to-fill capability, and strobe motion. The improved media composer of the invention enables a variety of wipes to be effected, zoom to full screen capability, pitch change audio scrub, graphics positioning and image capture instrumentation. The system also enables sync point editing and slip sync. The system also provides for a novel mechanical user interface including a track ball and speed control integrated into a single unit. Importantly, the system also supports a media consolidation process to free up disk space.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic diagram of the media composer system.

FIG. 2*a* is a prior art video compression configuration.

FIG. 2*b* is the video compression configuration according to the present invention.

FIG. 3 is a schematic view of the motion effects screen.

FIGS. 4*a* and 4*b* are schematic illustrations of the transition effects screen.

FIGS. 5*a* and 5*b* are schematic illustrations of image capture instrumentation.

FIG. 6 is an illustration of a keyboard layout.

FIG. 7 is a perspective view of the mechanical user interface according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIG. 1 the media composer system **10** includes a pair of CRT displays **12** and **14** and an audio output device **16** which may include two speakers. The video displays **12** and **14** and the audio transducer **16** are controlled by a computer **18**. It is preferred that the computer **18** be a Macintosh from Apple Computer Corporation designated as II_x, II_{ci}, II_{fx} or Quadra 900. Disk storage apparatus **20** communicates with the computer **18**. Disk storage **20** includes one to seven disks for media storage. The disks may be optical or magnetic. The system **10** is controlled by a keyboard **22** and a mechanical user interface **24** to be described in more detail herein.

In operation, video and audio source material is received by the system **10**, digitized and stored in the disk storage device **20**. The computer **18** is programmed so that the digitized source material may be edited and displayed on one of the video display devices such as the CRT display **12**. Typically digitized source material would be displayed at a location **26** and edited material at a location **28** on the display **12**.

As will be appreciated by those skilled in the art, reproducing full motion, 30 frames per second color video from a digital source is a daunting task. FIG. 2*a* illustrates a prior art system for providing digitization and compression of video images. This system includes a video coprocessor **29**, such as the NuVista board made by TrueVision of Indianapolis, Ind. Many other commercially available boards may also be used. A suitable video coprocessor includes a video frame grabber **30** which converts analog video information into digital information, representing each pixel of a frame with a predetermined number of bits, in this case 16-bits. The video coprocessor **29** has a memory **33** which is configured using a coprocessor **31**, such as the TI34010 made by Texas Instruments, to provide an output data path to feed JPEG circuitry, such as is available as chip CL550B from C-Cube of Milpitas, Calif. Such configuration can be performed using techniques known in the art. In the system of FIG. 2*a*, the output data path is 64 bits, divided into four banks of 16 bits. Two significant limitations exist in this situation. First the connection path between a video coprocessor **30** and JPEG compression circuitry **32** was a 50-wire design allowing only 16 bits to pass at one time (16 wires for data; 16 for control of data; others for synchronizing and system control). Second, the JPEG circuitry **32** (and the 16-bit connection) was driven by a 50 MHz clock which governed its speed to match adequately the 16-bit per cycle flow. The combination of these limitations resulted in an inability to process 640×480×24 (or 32) bit images at 60 fields per second. Typically users of the JPEG chip (c^3 CL550B chip) dealt with this by either shrinking the size of the image, reducing the bits per pixel information, or slowing the fields per second rate. All of this results in lower quality video.

FIG. 2*b* illustrates an improvement over the prior art. Similar components are used for the video coprocessor

29 and JPEG compression circuitry 32. The memory 33 of the video coprocessor 29, however, is configured to provide a 128-bit data path, wherein each pixel is represented by 24-bits. The connection between the coprocessor 29 and the JPEG compression circuitry is run at 70 MHz. The JPEG circuitry is programmed using known techniques to indicate that 24-bits of input data is used to represent a pixel. The net effect of these improvements is that the JPEG chip is run faster and receives more data, allowing compression of 60 frames per second of 640×480×24 (32) images.

The use of a 24-bit word for each pixel may increase compressed frame size depending on the content of a particular frame. A JPEG chip is configured for compression by providing two 8×8 quantization tables, which are well known in the art. The values are placed into these tables according to frequency. A "Q factor," a composite number which multiplies values in the tables, may be used to designate and scale values in this table. A high Q factor provides increased compression typically at the expense of resolution. A low Q factor improves resolution but typically increases compressed frame size. With most systems, if the Q factor is too low, and the compressed frame size is too high, the JPEG compression chip cannot compress incoming data at an adequate speed. Typically, when this happens, the user is notified, compression stops and a higher Q factor must be selected.

In an embodiment of the present invention, the compressed frame size is monitored in a manner to be described below. When it is determined that the compressed frame size is too large, the Q factor may be increased, or the tables adjusted, automatically. Conversely, if the compressed frame size is small, the Q factor may be decreased, or the tables changed, to increase resolution. The decrease or increase of the Q factor may be performed in a binary, step-wise or other suitable manner. Changing the Q factor changes all values in the table, and requires, at playback time, that the same table be used. As an alternative to changing the Q factor, the values in the table can be decreased for the highest frequencies first, and eventually for lower frequencies, depending on the desired increase or decrease in compression. For this purpose, a table may be maintained to relate a percentage of disparity between actual and desired compression to a number of values in the table to be decreased. If, for example, an actual compression of 22 K bytes/frame is achieved when 20 K bytes/frame was desired, a disparity of 10% is obtained. From this table, the number of frequencies to be decreased can be determined. The change can be made in a manner known to those of skill in this art. This dynamic adjustment, or roll-off, is not limited to use with systems representing pixels with 24-bit words. It may be used with other systems, such as the system of FIG. 2a.

The monitoring of the compression frame size will now be described. For this purpose, the coprocessor 31 is programmed, using well-known techniques, so that, at the end of each frame received, eight black lines are provided to the JPEG compression circuit. It then issues an interrupt signal, which is received by the host computer. By the time the host computer receives the interrupt signal, all data from the compressed frame is compressed and the only data remaining in the pipeline in the JPEG circuit are the extra black lines. Since part of the JPEG standard includes placing a marker at the beginning of the frame, the length of the compressed frame may be readily determined. Although the extra black lines become part of the compressed image, they are readily removed upon decompression and playback, by removing the last eight lines of each decompressed frame.

Table 1 illustrates the various hardware configurations for achieving different levels of resolution. In the table, JPEG III refers to the configuration shown in FIG. 2b.

The improved media composer of the invention allows the user to pre-visualize motion effects by creating clips and media files which display the requested effect. The new clip can be used like any other chip—it can be trimmed, extracted, overwritten, used in dissolves and wipes, etc.—and its media can be manipulated as any other, that is, it can be deleted, consolidated, and even back digitized. The new motion effect clips are video only. The start time code is zero hour regardless of the time code of the original clip. Motion effects can be created from master clips and subclips, but not from other motion effect clips. There is a delay as the media composer creates new media files. Motion effects are organized into three related features: variable speed, fit-to-fill, and strobe motion. These features are accessed through a single command in a source menu. A Motion Effects command opens a dialog box illustrated in FIG. 3. A preview dial 34 allows the operator to pre-visualize the effect even before the OK function 36 is clicked on. The dial 34 normally rotates at one revolution per second. When the operator enters values for an effect and clicks on PREVIEW, the dial rotates at the new appropriate speed. In this way, the preview dial works as a metronome to give the operator a feel for the pace or rhythm of the effect.

TABLE 1

Hardware Matrix (PRELIMINARY)

Res.	Depth	Audio	Max K/f		CPU	JPEG	Audio HW	Disks	Atto	Comments
					IIx	JPEG I	AudioMedia	Panasonic Opticals	Without	
					IIci	JPEG II	SA-4 & VSD or Pro I/O	600 MB	With	
					IIfx Quadra 900	JPEG III		1 GB 1.5 GB 5400 RPM		
VR1	24 bit	2 × 22 kHz	7	320 × 240	IIx	JPEG I	AudioMedia	Panasonic Opticals	Without	
VR2	24 bit	2 × 44 kHz	12	320 × 240	IIx	JPEG I	AudioMedia	600 MB	Without	
VR3	24 bit	2 × 48 kHz (one disk) 4 × 48 kHz (sep. disks)	18	640 × 240	IIx	JPEG I	SA-4 & VSD or Pro I/O	600 MB	Without	
VR4	24 bit	2 × 48 kHz	23	640 × 240	IIfx	JPEG II	SA-4 & VSD	1 GB	With	

TABLE 1-continued

Hardware Matrix (PRELIMINARY)

Res.	Depth	Audio	Max K/f		CPU	JPEG	Audio HW	Disks	Atto	Comments
		(one disk) 4 × 48 kHz (sep. disks)					or Pro I/O	(600 MB?)		
VR5	24 bit	4 × 48 kHz	40	640 × 240	IIfx	JPEG II	SA-4 & VSD or Pro I/O	5400 RPM	With	
R21	16 bit	4 × 48 kHz	20 × 2	640 × 240 × 2	Quadra 900	JPEGII	SA-4 & VSD or Pro I/O	5400 RPM	With	Maybe not 4.0
	24 bit					JPEG III				
Not for release in 4.0										
VR6		4 × 48 kHz	60	640 × 240	Quadra 900 (IIfx?)	JPEG III	SA-4 & VSD or Pro I/O	5400 RPM	With	Not for 4.0
VR22		4 × 48 kHz	30 × 2	640 × 240 × 2	Quadra 900	JPEG III	SA & VSD or Pro I/O	5400 RPM	With	Not for 4.0

Forward and reverse variable speed effects will now be discussed. First of all, the operator opens a clip in the source monitor 12 and marks an IN and an OUT, and chooses motion effects from the monitor 14 command menu. The operator then enters any one of three parameters: duration, play rate (in fps), or percent speed. When any one of these parameters is entered, the media composer immediately calculates and displays the values for the other two parameters. For example, if one marks a one second piece and enter 50% fps, the media composer will immediately show two seconds as the duration and 15 fps as the play rate of the new clip. One specifies reverse motion by entering an negative rate or percent speed. When the operator clicks on OK, the media composer creates a new clip and video/media file for the appropriate effect and loads this clip into the source monitor 12. It should be noted that when the operator asks for slow motion, the media composer creates a clip in which each frame is duplicated a proportionate number of times. Similarly, when one asks the media composer for fast motion, it creates a clip in which some portion of the source frames have been deleted. When these clips are played, the motion may appear jerky since the media composer is not synthesizing a smoothed series of frames. This effect is especially likely with material transferred from film.

The fit-to-fill option allows one to have the media composer calculate the motion effect required to fill a specific duration in a sequence with a specific duration from the source. The fit-to-fill check box 38 is bold only when the operator has marked an IN and OUT in both monitors 26 and 28 or the four marks are implied by the location of the position control. Given these values for the source (current) and target (new) durations, the media composer calculates the necessary rate in percent speed of the motion effect. One may accept these or enter one's own values. Once the media composer has created a new clip, one can overwrite or splice it into the sequence.

Strobe motion is a type of motion effect in which one frame is held for a specific duration and then the next for the same duration and so on. When one opens a clip in the source monitor, mark an IN and an OUT, and select strobe motion 40 in the motion effects dialog box. The operator must fill in the n in "update every n frames" 42. The new clip will have the same duration as the current one but only even nth frame is displayed. A Remake Effects command recreates dissolve media files and includes all motion effects. As with transition effects it is only possible to recreate motion effect media files when the original source media is online. When the operator batch digitizes a sequence which includes motion effects, the effects are automatically recreated at the end of the process. Motion effects are represented correctly in all supported edit decision list (EDL) formats with the following caveat: It may not be possible to express accurately the media composer motion effect in an EDL because the format may limit the precision with which percent speed can be expressed to whole numbers or one decimal place and the media composer is not likewise limited. In this case, the media composer appropriately truncates the rate or percent speed in the EDL and generates a comment which indicates the true rate or percent speed. With the exception of freeze flames, motion effects are ignored by auto-assembly. Auto-assembly edits video from an original clip at 30 frames per second, starting at the edit inpoint and filling the duration of the effect.

The improved media composer will allow the operator to play four tracks of audio simultaneously instead of only two as in earlier versions. The four tracks are not output through four separate channels, rather only two. The operator hears the tracks through two speakers 16 (FIG. 1) according to the pan setting for each track. In addition, it is not possible to digitize simultaneously four channels of audio. The operator can specify which tracks are candidates to be played by tagging them with speakers on an edit panel. When the operator chooses 1) to play a sequence, 2) to record a digital cut, or 3) to auto assemble a sequence with direct audio, the audio tracks will be output through two channels according to the pan setting for every component on each track. The two output channels can be either analog or digital according to the wiring of an audio interface unit. If the user selects audio from tapes, auto-assembly will execute edits for audio channels 3 and/or 4. If the selected EDL format supports four channels, the EDL will include edits for channels 3 and/or 4. The EDL formats which support 4 channels are CMX 3600, Sony 9000 and GVG 4.1. In both the EDL tool and auto-assembly, the user can specify which media composer tracks are output as channels 1, 2, 3 and 4. One should note that it is not possible to digitize or output four analog channels of audio simultaneously. However, regardless of the software limitations, it is not possible to output four digital channels of audio because of limitations in the audio interface.

The media composer of the invention will allow the operator to digitize audio at a 48 KHz sample rate. However, it is not possible to use both 48 and 22 KHz or 44 KHz audio in the same sequence. Thus, 48 KHz must be used exclusively when playing a sequence or

batch digitizing. When working with the audio interface and video slave driver and 48 KHz audio is selected in the digitized selections dialog box, the media composer automatically adjusts the sample rate on the audio interface. However, one must manually switch the video slave driver from 44 to 48 KHz. Digitizing mixed audio allows one to save space by combining the material in two audio channels into a single media file which is played from both speakers 16. All other audio features, including crossfades, mixdown, and both types of audio scrub, work with 48 KHz audio. The minimum audio hardware required to digitize 48 KHz is a SA-4 card and either the Pro I/O or Pro Tools. This hardware is available from Digidesign of Menlo Park, Calif. The media composer improves 22 KHz audio by automatically increasing the amplitude of low-level signals.

The media composer of the invention offers wipes as a transition effect. Wipes are accessed through a Transition Effect command. This command opens a dialog box 44 (FIG. 4*a*) which allows the user to choose in a pop-up menu between the two transition effects: dissolve and wipe. When wipe is selected, the operator can choose a pattern from a menu of sixteen choices 46 (displayed graphically) and a direction—forward or reverse as shown in FIG. 4*b*. Forward means that the outgoing clip is represented by the white in the pattern from the menu 46 and the incoming by the black (actually blue). Reverse means the incoming is represented by the white. Regardless of whether the operator chooses dissolve or wipe, the duration must be entered in frames, its start relative to the transition (starting, centered, ending, or offset) and a target drive for the media files.

The effect can be viewed only after the media composer creates a media file for the specified wipe or dissolve. These effect files will be created, deleted, and recreated in exactly the same way dissolve media files have been in earlier versions. The Remake Effects command includes all transition effects. As with motion effects, it is only possible to recreate transition effect media files when the original source media is online. For example, media for both the incoming and outgoing clip must be online for the media composer to recreate the dissolve between them. When a sequence which includes transition effects is digitized, the effects are automatically recreated at the end of the process. All wipes are expressed correctly in all EDL formats. A dialog box from the EDL Tool allows one to specify the appropriate pattern number for each wipe pattern. The table of numbers and patterns is stored in a file which can be moved from on media composer to another. It is not, however, possible to save and choose among several different sets of values. The present media composer will also allow the operator to zoom to full-screen mode from any monitor (source, record, pop-up) by pressing the quote key. All keyboard equivalents function in full-screen mode. The one exception is that one cannot use Trim Mode while in full-screen play.

The media composer of the present invention allows the operator to enter a mode in which a mouse controller can be used as a shuttle control. Hit L to shuttle forward, Play (the 5 and Back Quote Keys) to shuttle at 30 fps, K (or click a mouse button) to pause (zero speed), J to shuttle backward, and the Space Bar to exit the Shuttle Mode. Hit L twice to shuttle at 60 fps, thrice to shuttle at 90 fps. Hit J twice for −60 and thrice for −90. While shuttling at zero speed, either full-screen or normal, many of the keyboard functions are active. It is possible to step through the program, clear marks, use both kinds of audio scrub (see below), go to the next or previous edit, show safe titles, etc. If the media composer cannot do the function and remain in Shuttle Mode, the mode is dropped and the function performed. Toggling between source and record is an example of such an operation. In one embodiment of the present invention, jog shuttling may be performed, with a result which is similar to that obtained using mechanical jog shuttle controls in connection with video tape recorders. With digitized images being played, a mouse or similar input device can provide control for jog shuttling. Jog mode begins when an operator pressed a button. While the button is depressed, movement of the mouse in one direction or another determines the speed of shuttling, or of playback. That is, the position of the mouse when the button is depressed is used as a reference position. With a relationship defined between position and playing speed, the further the operator moves the mouse from the reference position, the faster video is played back in a given direction. For example, movement of the mouse to the right increases the forward playing speed. If the mouse is returned to the reference position, playing stops. As the mouse is moved to the left, the reverse playing speed increases.

An important aspect of the present media composer is a pitch change audio scrub feature. When the operator shuttles through footage, smooth, continuous audio will be produced at the corresponding speed. That is, pitch will vary with the speed as with an analog tape. This feature is available for one track only. Designate the track for smooth scrub by option clicking (or double clicking) on the speaker icon for that track. The icon becomes an outline. Smooth scrub is available whenever the operator is shuttling, using either the mouse or the shuttle control (beneath the Play button on a keyboard discussed below) to determine the shuttle speed.

When the operator imports a graphic into the media composer and edits it onto the G track of the sequence, it may not be positioned optimally with respect to the underlying video. When the position control is within the graphic element, you can drag the graphic to a more desirable position. Option-drag is for fine control and control-click will move the graphic to its original centered position. During dragging, the media composer displays a special window with information about the graphic's current position relative to the center (its original position) and relative to its position immediately before it was moved. Both of these positions are measured in pixels along the horizontal and vertical axes.

The improved media composer of the invention has been updated to provide image input and output instrumentation in the form of a waveform monitor, a vectorscope and black level controls as shown in FIGS. 5*a* and 5*b*. This improved Video Tool allows the operator to save and load settings for contrast, luminance, hue and saturation. Such settings control the video coprocessor 29 and adjust incoming data. The waveform generator and vectorscope are analogous to their analog counterparts which are well known in the art. An operator viewing the waveform generator and vectorscope may use the sliders 100, 101, 102 and 103 to respectively set values for hue, saturation, luminance and contrast. These values control the video processor, in a manner known in the arts which adjusts incoming data accordingly. The line of a frame may be selected for

viewing using slider 104. The use of sliders as an interface to allow an operator to set values is well known in the art.

Keyboard layout is shown in FIG. 6 and the function of the keys is set forth in Table 2. The keyboard 22 is augmented by the mechanical user interface 24. The mechanical user interface 24 is shown in more detail in FIG. 7. The interface 24 includes a track ball 50 and a speed controller 52. As with a mouse, the track ball 50 may be used to locate a cursor on the monitors. Buttons 54 and 56 serve functions like those provided by the click button on a mouse. It is preferred that the speed control 52 have detents for zero speed normal forward speed (30 frames per second) and a reverse normal speed. It is also preferred that the speed control 52 be spring loaded to return to the zero speed position. It is contemplated that additional buttons 58 be provided so that a user may program their functionality.

Yet another aspect of the improved media composer is sync point editing which allows the operator to specify a position in one monitor that is desired to be in sync with the position in the other monitor. The operator then performs an overwrite that preserves that sync relationship. Sync point editing (SPE) is accessed using the SPE command in the media composer menu. Sync point editing is performed in three steps. First, a point is specified in the destination, or record, clip, for example by placing a mouse cursor on the displayed frame of the clip and pressing the mouse button. The location within the clip is then stored. Second, a point in the source material is identified in a similar manner. Third, the size of the source information is specified, for example, by using IN and OUT markers. These steps may, in fact, be performed in any order, which may be defined by the programmer of the computer. After these three steps are completed, the source information is overwritten in the destination, or record, information, by placing the identified source location at the specified destination location. Such sync point editing may be performed with any combination of audio and video clips. Typically, it is performed to synchronize recorded sound to an event in a video clip. The operator may then turn PHANTOM marks on in the media composer window to see how the PHANTOM marks behave in relation to the position control in the record monitor 28. With SPE off, the system uses the current position as the IN; with SPE on, the current position is the sync point. It should be noted that one can mark the IN and OUT in the record monitor 28 instead of the source monitor 26.

TABLE 2

Function	USB (y/n)	Keyboard Equivalent	Notes
1-Frame Back		3	motion control button
1-Frame Forward		4	motion control button
10-Frame Back		1	motion control button
10-Frame Forward		2	motion control button
A1 track on/off		9	track selector
A2 track on/off		0	track selector
A3 track on/off		-	track selector
A4 track on/off		=	track selector
activate source/record monitor		ESCAPE	moved from * on numeric keypad
All Stop		SPACE BAR	
Clear IN	Y	D	
Clear OUT	Y	F	
Clear Marks	Y	G	
Copy to Clipboard	Y	C	
Exit Mouse Shuttle		SPACE BAR	
Extract	Y	X	
Fast Forward		U	deck control function
Find Frame	Y	[	
Full Screen on/off		'	mode toggle
Go to IN	Y	Q	
Go to OUT	Y	W	
Go to Prev Edit	Y	A	
Go to Next Edit	Y	S	
Graphics track on/off		7	track selector
Lift	Y	Z	
Mark Clip	Y	T	
Mark IN	Y	E, I	two equivalents for convenience
Mark OUT	Y	R, O	two equivalents for convenience
Minus 10 Frames		M	Trim Mode function-trim buttons
Minus 1 Frame		<	Trim Mode function-trim buttons
Overwrite	Y	B	
Pause		K	except in Trim Mode; mouse shuttle and deck control function
Play	Y	5	moved from Tab. The big Play button can be configured as Play IN to OUT or Shuttle Forward
Play IN to OUT	Y	6	see Play
Plus 1 Frame		>	Trim Mode function-trim buttons
Plus 10 Frames		/	Trim Mode function-trim buttons
Rewind		Y	deck control function
Safe Title/Action	Y	]	
Shuttle Back		J	mouse shuttle and deck control function
Shuttle Forward		L	except in Trim Mode; mouse shuttle and deck control function
Slip Left (1 frame)	Y	<	except in Trim Mode
Slip Left (10 frames)		M	except in Trim Mode
Slip Right (1 frame)	Y	>	except in Trim Mode
Slip Right (10 frames)		?	except in Trim Mode

TABLE 2-continued

Function	USB (y/n)	Keyboard Equivalent	Notes
Splice	Y	V	
Trim Both		L	only in Trim Mode
Trim Incoming		;	only in Trim Mode
Trim Outgoing		K	only in Trim Mode
Video track on/off		8	track selector
Delete Clip/Sequence (from a bin)		DELETE	opens delete dialog box from Bin menu

Another aspect of the invention is slip-sync editing. This kind of editing typically refers to maintaining synchronization between a series of video clips and corresponding audio clips when transitions between clips are trimmed. In prior art systems, when an audio clip was trimmed, i.e., made shorter, subsequent clips became out of synchronization with their corresponding video clips. In the present system, when audio material is removed from one end of an audio segment from a clip, source material from the original audio clip is added to the other end of the segment so as to maintain the length of the audio segment. The source material can readily be retrieved from the memory location or disk on which it is stored. Thus, the synchronization of subsequent clips is maintained.

Another aspect of the invention allows placement of graphics material interactively on a frame or frames of a video clip. Graphics material may be generated using standard, well-known graphics applications programs, and may be in standard formats, such as PICT format. A data file for graphics material may be accessed and displayed along with a frame from a video clip. Its position may be adjusted by placing, for example, a mouse cursor on the graphics. When an appropriate position has been determined by an operator, the graphics may be made a permanent part of the video clip.

Another aspect of the invention is known as media consolidate. Media consolidate allows a user to select a set of clips in sequences and then copy media data from the media files referred to by that set into new media files on a target disk. A user would typically use this feature when he/she is done or almost done with a project and wants to free up most of his disk space but wants to be able to do more work at some later date without having to redigitize. By consolidating his media to a single disk, the remaining disks can be used for the next project. Of course, if the target disk is removable, all the drives in the media composer can be freed up. It is noted that the source media must be on line for media consolidate to work since it is not going back to the original tapes.

What is claimed is:

1. Media composer for editing source material comprising:

digitizing apparatus for receiving, and digitizing video and audio source material;

storage to receive the video and audio source material;

computing apparatus including compression apparatus responsive to the digitizing apparatus, said compression apparatus being for compressing and storing the source material in the storage, wherein the computing apparatus is responsive to the storage to determine if the source material occupies more than a target amount of the storage and provide an indication if the source material does occupy more than the target amount of the storage, wherein the compression apparatus is responsive to the indication to adjust its compression if the source material does occupy more than the target amount of the storage, the computing apparatus further being for manipulating the stored source material;

output apparatus communicating with the computing apparatus for displaying the manipulated source material and control information;

wherein the computing apparatus is programmed so that multiple resolutions can be displayed, recorded and played back.

2. The media composer of claim 1 wherein the compression apparatus is a JPEG compression apparatus and includes dynamic adjustment of tables in a JPEG chip to improve compression roll off.

3. The media composer of claim 1 further including a video coprocessor and including a 128-bit wide data path between the JPEG compression apparatus and the video coprocessor.

4. The media composer of claim 1 wherein the computing apparatus is programmed to provide motion effects in the display material and is further programmed to provide a dial whose rotation rate corresponds with a selected motion effect rate.

5. The media composer of claim 1 wherein the compression apparatus is a JPEG compression apparatus and wherein the clock speed in the JPEG compression apparatus runs at 70 MHz.

6. The media composer of claim 1 wherein the source material is digitized to a 24-bit word for each pixel.

7. The media composer of claim 1 further including a mechanical user interface including a track ball and a speed controller.

8. The media composer of claim 1 wherein the computing apparatus is programmed to generate smooth continuous audio having a pitch corresponding to the speed of video material being displayed.

9. The media composer of claim 1 wherein the computing apparatus is further programmed to consolidate media to a single disk in the system.

10. The media composer of claim 1 wherein the display apparatus includes a source monitor and a record monitor and wherein the computing apparatus is programmed so that a video sequence in the source monitor may be overwritten onto a sequence in the record monitor wherein synchronism is maintained between a selected frame in the source monitor sequence and a selected frame in the record monitor.

11. The media composer of claim 1 further including a mouse controller connected with a keyboard, the mouse controller adapted to function as a shuttle control.

12. The media composer of claim 1 further adapted to import a graphic for editing onto a video track wherein the position of the graphic may be controlled and its position displayed in the display apparatus relative to its

original position or to its position immediately before the graphic has been moved.

13. A media composer of claim 1 wherein the computing apparatus is programmed to display video wave forms, a vectorscope and black level controls.

14. The media composer of claim 1 wherein the computing apparatus is responsive to the compression apparatus to receive an interrupt from the compression apparatus before the compression apparatus has finished compressing the source material.

15. The media composer of claim 14 wherein the compression apparatus is adapted to send blank video information to the computing apparatus after generating an interrupt.

16. The media composer of claim 15 wherein the blank video information comprises 8 blank lines.

17. The media composer of claim 1 wherein the compression apparatus is a JPEG compression apparatus, and wherein the compression apparatus is constructed to increase a JPEG queue factor in response to the indication.

18. The media composer of claim 1 wherein the compression apparatus is a JPEG compression apparatus and wherein the compression apparatus is instructed to adjust compression table values in response to the indication.

19. The media composer of claim 1 wherein the computing apparatus is constructed to provide a disparity value to the compression apparatus.

20. The media composer of claim 19 wherein the compression apparatus is a JPEG compression apparatus and wherein the compression processor is responsive to the disparity value to determine a number of frequencies to be decreased in JPEG processing.

* * * * *

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[54] MEDIA STORAGE AND RETRIEVAL SYSTEM

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[58] Field of Search ... 364/200 MS File, 900 MS File; 369/14, 34, 83; 360/13, 14.1, 14.2, 14.3; 395/425, 600

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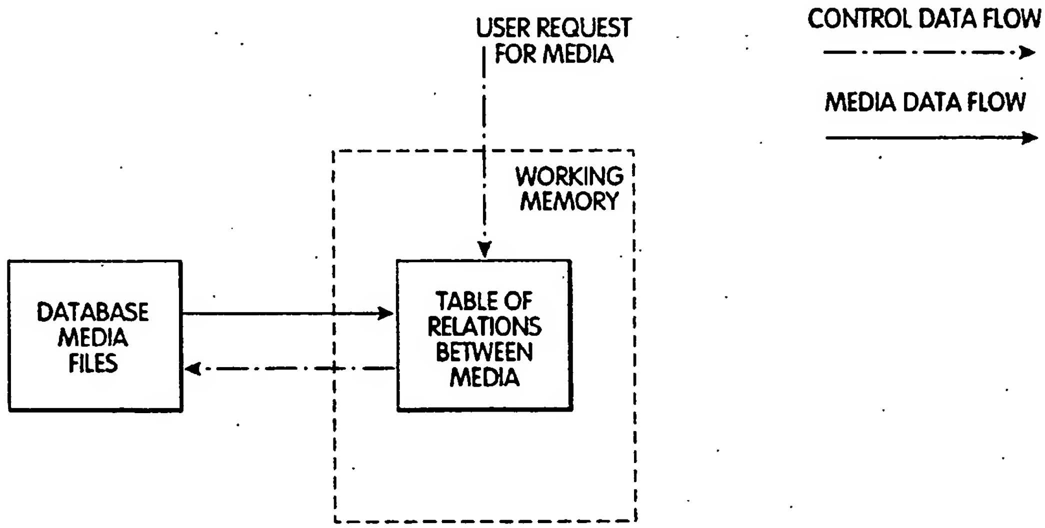
[57] ABSTRACT

A system for the management of media data and indexing of media data based on user instructions. A system for the management of relational information between media sources is provided as is a method for determining media data associated with requests based on source identifiers and range specification on the source of the data.

7 Claims, 2 Drawing Sheets

Microfiche Appendix Included
(73 Microfiche, 1 Pages)



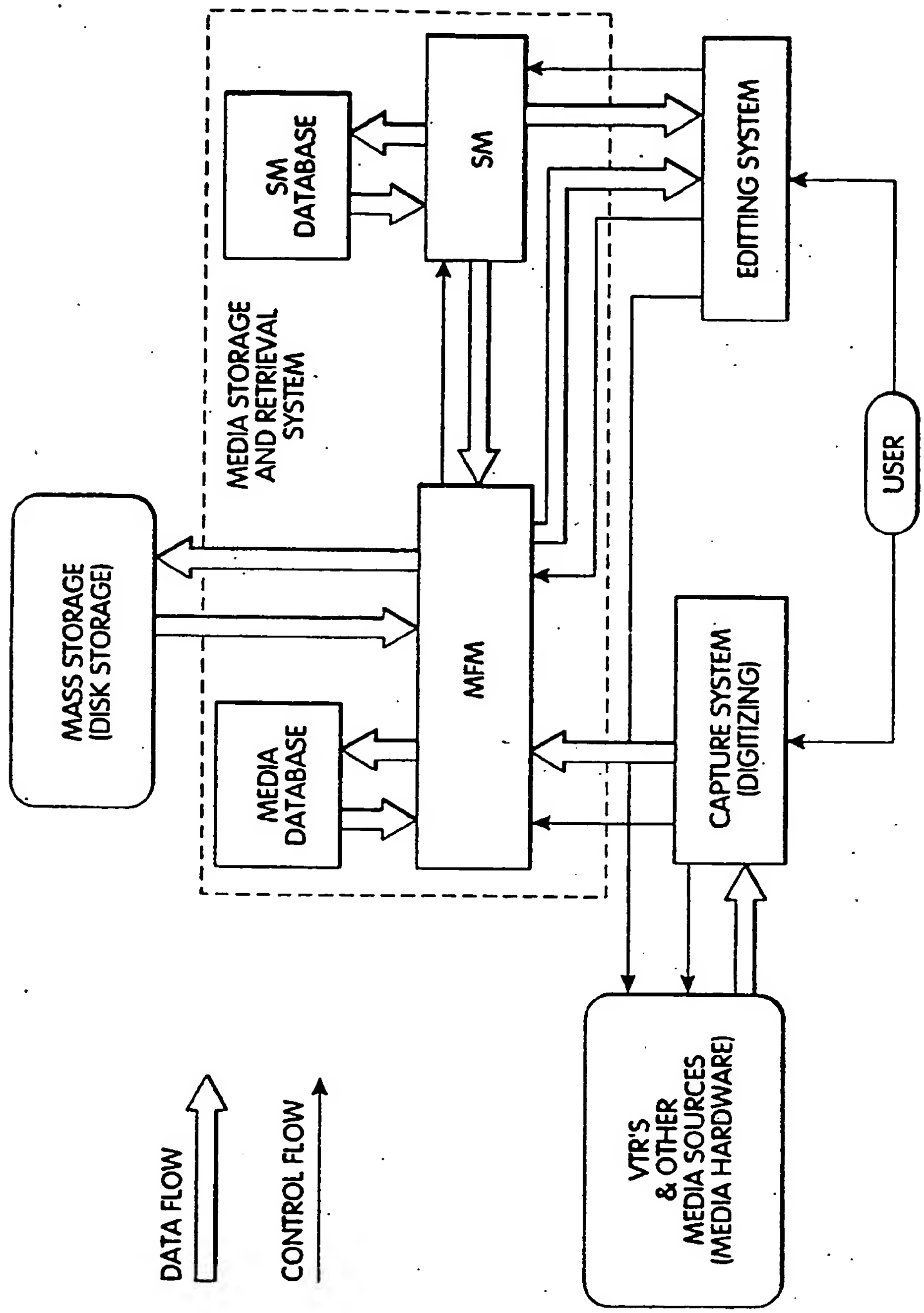

SM DATABASE
SM
EDITTING SYSTEM
MEDIA STORAGE AND RETRIEVAL SYSTEM
USER
MASS STORAGE (DISK STORAGE)
MFM
MEDIA DATABASE
CAPTURE SYSTEM (DIGITIZING)
VTR'S & OTHER MEDIA SOURCES (MEDIA HARDWARE)
DATA FLOW
CONTROL FLOW

Fig. 1

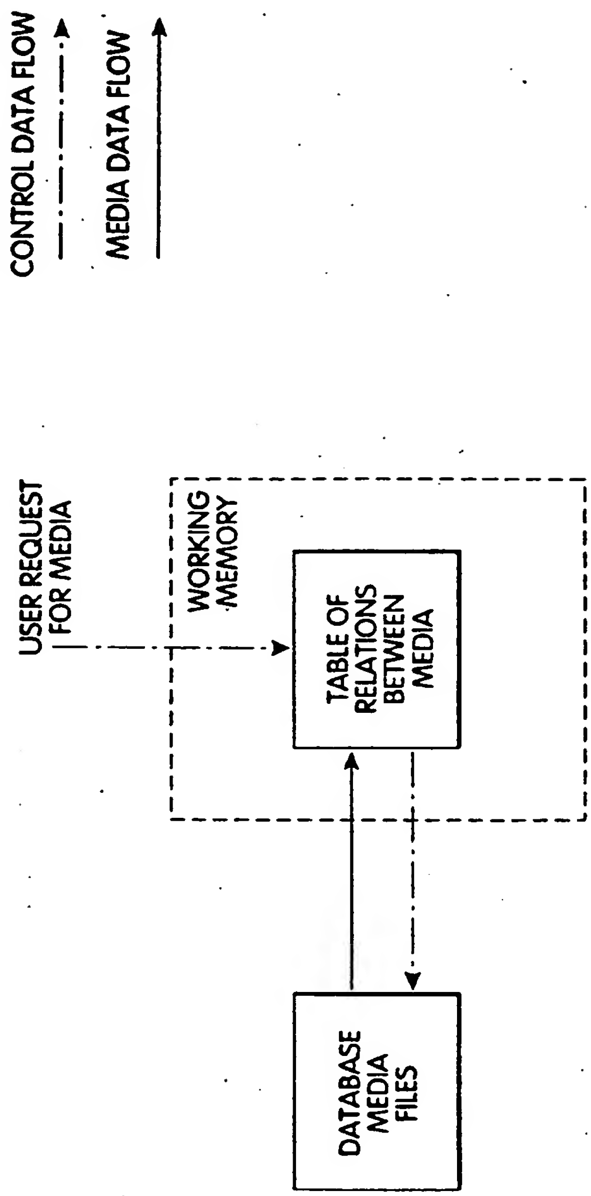

CONTROL DATA FLOW
MEDIA DATA FLOW
USER REQUEST FOR MEDIA
WORKING MEMORY
TABLE OF RELATIONS BETWEEN MEDIA
DATABASE MEDIA FILES

Fig. 2

MEDIA STORAGE AND RETRIEVAL SYSTEM

REFERENCE TO MICROFICHE APPENDIX

The application includes a microfiche appendix pursuant to 37 CFR §1.96(b) containing 1 microfiche with 76 frames.

BACKGROUND OF THE INVENTION

The invention relates to non-linear editing systems and the storage and retrieval of the media associated with the system, i.e., video and audio data.

Non-linear editing on computer oriented systems involves digitizing media data recorded from a linear source, e.g., a video tape cassette, and storing the digitized media data on a storage device, e.g., a hard disk drive. Once digitized, the media data can be accessed quickly at any point in the linear sequence in which it was recorded so that various portions of the data can be accessed and edited in a non-linear way.

Editing in either a linear or non-linear system involves a similar principle. Source material from some source (video tape, audio recording, film etc.) is broken down into a series of separate "clips" representing the material desired for the final master, and then reassembling these "clips" into a final sequence achieving the desire of the editor and producer. "Clips" can be either video or audio material or both (synchronous audio and video.) In a non-linear system the typical approach involved alloting to each clip an associated digitized section of the original source in storage on the system in a "media file." The system would allow the user to manipulate the clips in order to produce the final sequence. The clips referred to the media files when certain specific information about the source media was needed, such as the original source name or nature of the media (video or audio), or when the need arose to actually view or hear (i.e., play) the media associated with the clip.

For example, a user editing on a non-linear system had the ability to manipulate clips into any order, use audio clips with other video clips, and create new clips by using smaller pieces of other clips. Tools existed to allow the user to combine clips of similar material for other effects. Video clips were used in combination to create dissolve effects, and audio clips to create various audio effects.

Typically, the output of an edit, i.e., an editing procedure such as the one described above, is an "Edit Decision List" (EDL) which can be used either by a conventional on-line editing system such as the CMX300 or a non-linear system to create or assemble a new linear sequence from other existing linear source material, e.g., video tape. The EDL is used to direct the on-line system to locate or "cue" the first frame of a desired clip which is recorded on a source video tape and loaded into a video tape recorder (VTR). The editing system then records the cued clip onto a target or destination medium, e.g., video tape, and cues the first frame of the next desired clip. (Note that the next desired clip may be recorded on the same or a different physical source medium as the first clip). Once cued, the editing system records the next desired clip onto the target medium. This process is repeated until the EDL is exhausted and the target medium represents the selected original material reorganized into the sequence described by the EDL.

The standard or conventional method when establishing a system of media archival is as follows: As each clip of source material is captured for storage in the system, the information about the clip and its actual digitized data is either coresident or linked directly at the time of the capture. Whenever the clip is referenced by the user of the system, the media associated with it is always the same particular one that was associated with it at the time of the capture (whether the media was digitized or actually was still intact on the original source). Any manipulation or editing concerning the clip or segment would directly use the media data tied to it for viewing or playback. Any information about the source that it came from or equivalent sources would need to be stored with each clip or segment. As such, the whole collection of clips or segments would be needed at any time in order to determine the breadth of any source relationships. And as new source relationships were developed it would be difficult if not impossible to inform all clips or segments of the new information. Additionally, tying the media data directly to a clip or segment would make it necessary to duplicate media data if certain clips or segments overlapped or were contained entirely within one another.

The invention solves these and other difficulties and problems.

SUMMARY OF THE INVENTION

The invention involves dynamically linking or binding a digitized representation of the media with a specific reference to the media at the time the information is needed at run time and being able to change the binding as certain facets in the system change. To that end the invention is a system for determining the media needed at the time a clip is requested to be played, viewed or information retrieved concerning the media associated with the clip. Specifically, each clip is dynamically connected to the specific media at the time that it needs access to the media associated with it.

The invention also involves the separation of information concerning the specifics of a piece of digitized media, information specific about the source material the media was derived from, and information concerning the connection of media data to those requesting or needing access to it. Specifically, the three groups of information that are distinctly separate from each other are:

(1) the information concerning physical source mediums may indicate which sets (or subsets) of physical source material are equivalent, or make correlations in the labeling of certain segments of the source material (example: film edge numbers equivalenced (i.e., correlated with time code);

(2) the information about the specific digitized media as to the type of media, the length of the data, the range on the source the media represents and the locations of such media resources; and

(3) the information concerning the binding of the media data to the requesters of media. Included in the invention is the concept that the binding of media resources to those in need of the media is not made until the request for the media is made, and the fulfillment of the request may change depending on the media available at the time of the request.

The invention also involves the method of storage and retrieval of the necessary source relational information from one invocation of the application to the next, such that it is coresident with the clips and/or media

that it is specific for. This makes knowledge of the form of information storage inperceptable to the user of the system.

Advantages of such a system are described below:

Media need only be digitized once. Clips referring in part or in whole to the same media result in references to the same physical data in the system. Duplicate copies of the media are not needed or created.

Deletion and recapturing of segments of the original source results in all clips referring to the specific new source material entered into the system.

Clips requesting media from one physical source may receive media from a distinctly different physical source if the sources have been identified as equivalent.

Actual location of the media in storage is free to move to any location on disk, without notification necessary to clips requiring reference to the media.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram shown the control and media data flow among the media file manager, the source manager, media storage, and media capture and editing facilities.

FIG. 2 is a block diagram showing the control and media data flow between the media database and the table containing media equivalency relationships.

DESCRIPTION OF PREFERRED EMBODIMENT

FIG. 1 is a block diagram illustrating the overall functional relationships of the media storage and retrieval system according to the invention, with media hardware, disk storage and the user interface.

As shown in FIG. 1, media sources such as VTRs containing linear media data are controlled via editing and capture systems under the user's control. Digitized media data from the capture system is transferred and stored on a mass storage volume such as a hard disk drive as digitized media files and selectively retrieved under the control of a media storage and retrieval system which is the subject of the present application. The media storage and retrieval system is implemented preferably as a software application having two distinct components: the media file manager (MFM) and the source manager (SM) along with their respective databases, namely, the media database and the SM database. A user accesses and operates on the digitized media files via calls placed by the editing system to the MFM which both creates and manages the media files. The MFM also interacts with the SM which inter alia maintains a table of relations between the linear media data, recorded, for example, on source tapes, and the digitized media files. MFM exists in modular software form and consists of a procedural interface that accepts requests for specific pieces of media from specific source material. SM exists in modular form and consists of a procedural interface that accepts requests for source material relational information, and requests to read or write source relational and specific information to an area of storage.

The source code appendix provides specific code for implementing both MFM and SM. The system makes use of two other procedural subsystems: one being a linked data list manager, and the other being a sectional file writing and reading manager. These subsystems are conventional utilities sometimes offered as "toolboxes".

Linked data list management involves the functions of linking together records of information in some order. Other procedural interactions with this tool make it possible to sort the records in a variety of orders depending on certain key fields in the records. The list manager is also able to "sift" certain records from the entire pool of records based on requested values of key fields in the records.

Sectional file writing utility provides the ability for multiple clients to write data to the same file and retrieve it without knowledge of either the format of the file or the identity of other clients using the file.

MEDIA FILE MANAGER

Media File Manager (MFM) is responsible for the management of all media that is present at any time and available to the system for use. This media may be media recorded earlier and stored in some medium, or available on demand via some link to mechanical devices. The media may be duplicately represented in a variety of resolutions or qualities. MFM's purpose is to locate media (or information pertaining thereto) specified by a user request consisting of a range of time from some specific source. The range in time may be specified by the now common SMPTE time code, film edge numbers, real time or some other standard of range identification of source material. The request does consist of a specific source from which the media is desired. This specific source request is unique and the system works on the concept that identifiers exist that separately identify any source medium.

At any time after the system is initialized the MFM has an internal abbreviation (i.e., a log or set of records) of all the media that is known to be accessible to it, and where and how that material may be retrieved. The internal abbreviation is contained in the media database built by the MFM. When a client of the MFM requests information or access to actual media, MFM uses its internal abbreviation of the media available to determine a media source that will serve as a satisfactory response to the client's request. A MFM identifier is returned to the client. In any other requests for the specific media the client may use the identifier for quick access to the material. This identifier represents the dynamic link or binding of a client's need for media and the actual source of media to be used. This identifier remains constant to the client, and any media deletions, changes or additions are changed internally by the MFM, i.e., transparently to the user, and have corresponding effects on any identifiers already released. As described in the procedural interface, two different types of identifiers can be released by the MFM. For the sake of differentiation, one type is designated a MFM_CRUX and the other a MFM_GIST, the main difference between these being a level of privilege available to the client holding one and/or the other. The holder of a MFM_CRUX is able to make any number of procedural calls to MFM requesting information about the media, but the privilege to read or write the actual media is withheld. Using a MFM_CRUX, the client can call a routine mfm open which will give the client a MFM_GIST identifier. This identifier is accepted by mfm_read and mfm_close to be able to read the actual media from the file. The reason for this is to give the MFM some control over which physical connections to actual media are opened or closed. On some systems this is desired as the number of channels to existing media may be limited, and MFM needs a method of managing access.

MEDIA FILE PROCEDURAL INTERFACE

The media file manager (MFM) is a procedural interface between a media requester and the media files themselves. The interface consists of a set of software modules which are described below.

mfm init

Mfm_init is called at the time the application is invoked. It is a one-time operation. Its basic functionality is to initialize the linked list data structures that will be needed and determine all media available on the system at the current time. Functionally it scans all the disk drives on the system and determines if the short-hand version of the media file database which it has previously placed on the drive is valid. This is determined by comparing the time stamp on the file with the time stamp on the directory in which it was stored. If they are equal (they are made equal when the database was written) then the database is valid and MFM proceeds to read in the information pertaining to it into RAM using the sectional file routines and then passes the file to the SM (sm13 readNtable) so that it can read in the SM information stored there. Of course, the file itself is not transferred; only its address in memory. If it is invalid then the file is passed to the SM for processing the SM information contained in it (see mfm_quit), and then all media files on the volume are scanned individually. In the reading of the media databases and the scanning of the other drives the run time media database (FIG. 1) is initialized with its original media.

mfm_handle

Mfm_handle is the call a client, e.g., the user interface (FIG. 1), uses to receive an identifier (MFM_CRUX) giving inquiry rights on the media and for determining a binding between the request and an actual media source. The request is comprised of a source unique identifier or "id", a range on the source, type of media (video or audio,) and the physical channel requested if any that the source media was recorded from (for instance the type of media may be audio, and the physical channel may be two, indicating audio2 media). To handle the request MFM sifts through its existing linked list of records based on the values of the request. (This is actually done with search support procedures within the linked list utility.) If a match is found then the handle to that record is returned in the form of a MFM_CRUX. If no media is found, then MFM calls SM_relate to determine if any other source material has equivalent material contained in it, equal to that being requested by the client. If so, MFM then again sifts its database, looking for the appropriate media on these other sources. If any is found a MFM_CRUX handle is returned to the client. If no media is obtained via any of these methods, mfm_handle returns a MFM_CRUX for BLACK or SILENCE depending on the media type originally requested, and flags an error message that no media as requested was available.

mfm_open

Mfm_open is called by the client when it will be necessary to actually obtain media data from the media source. Mfm_open accepts a MFM_CRUX identifier, which the client/requester must have already obtained, and proceeds to establish a connection with the media source (open the file). Once the connection is established the client is given a MFM_GIST identifier. This identifier can be used with mfm_read calls to obtain the actual raw media data.

mfm_read

Mfm_read is the procedural interface used to pass actual media data from the media source into a buffer specified by the caller. The parameters to the call are designed such that the caller asks for a frame of information using a range identifier to identify the frame offset from zero of the range scale. For example in the time code ranging method, the caller asks for the absolute time code of the frame desired. The call analyzes the type of media being requested, the size of the buffer the caller has provided and the number of frames the caller has requested. Based on this information a best fit is made for the caller's buffer and the actual number of frames passed to the buffer is returned.

mfm_close

Mfm_close is used to allow MFM to close the channel to the media source. The call accepts a MFM_GIST identifier and from this identifier MFM is able to distinguish if the media channel is open for write (a previous mfm_create call), or open for read (a previous mfm_open call).

If the media channel is open for write, the call examines a parameter which indicates caller specific information about the nature of the write to the channel. Length, range identifier, media identifier and data rate over time are all specified. MFM includes this information in the media channel in a header and then closes the channel. This media channel (source) is now available in the MFM database as a possible candidate for fulfilling a mfm_handle request.

If on the other hand the channel was open for read (via a previous mfm_open) the channel is simply noted as being closed for that particular client, and if no other clients are using the channel then the channel is closed.

Regardless of the type of closure, the MFM_GIST identifier passed in is no longer valid, and a MFM_CRUX identifier is passed back to the caller. This identifier would be used in further calls to mfm_open if the client again desired an open channel to the media data.

The call mfm_close also makes decisions on the type of channel being created. Two types are possible, temporary and disk resident. A temporary media channel exists in memory only for the duration of the application run, disk resident files are placed on disk and will be available at the time of the next application invocation. For example, an experimental dissolve effect on two other video media channels might become a temporary file, while actual video from an external source might be captured, digitized and stored in a disk resident file.

mfm_create

Mfm_create is the procedural interface used by the client who wishes to permanently store media data on file 30 with the MFM. The call grants the caller a MFM_GIST identifier allowing calls to mfm_write to actually write the media data to a open channel. At the time of the call MFM checks its available space for recording of such information and sets up to receive media data into such space. Specifically mfm_create creates files on disk and preallocates their size as large as possible. The initial header on the file is created and it is cast a media channel in the stage of creation. In this way it can be identified later if the caller fails to write data to the channel, or fails to close the channel (via mfm_close.)

mfm_write

Mfm_write is the procedural interface used by the caller to actually transfer media data obtained from source into a media channel of the MFM. It is in this

way that MFM is able to store media data for use later as a media source in response to mfm_handle requests.

Specifically the call takes in a pointer to a buffer containing the data and a length on this particular buffer. The data is copied from the buffer for the specified length into the media channel identified by the MFM_GIST identifier handled in via a previous call to mfm_create. The buffer information is simply copied onto the end of any data already written to the channel. The channel may be a temporary channel (main memory) or a disk resident channel (disk file). The two types of records are structured according to the following formats.

Runtime MFM record structure

One of these is present in memory at runtime for each known media file out on disk.
See C typedef for MFM_Crux_t in mfm_pvt.h

Channel identifier
This is the physical channel associated with the media type from the physical source. Ie: Two tracks of audio from the same source would be differentiated by different channel identifiers.

File_use
An internal identifier indicating whether the media file is open for access and if so the nature of the open, read or write.

Media Type
This is an internal identifier indication what type of media data is stored in the file. Ie: video or audio or some other.

File Type
This is an internal identifier as to the format of the media stored in the file.

Volume ID
Dir ID
Filename
These three fields together indicate the exact position on disk such that the file can be opened, read, written or closed.

UID
This is the unique source medium identifier. This is the uid that the SM tracks and manages in its database.

Start_time
This is the range identifier for the position in the source that the beginning of the media data in this file corresponds to.

End_time
End range identifier

Media_specific
This is a optional area for storage of specific information for this particular type of media.

Diskfile MFM header

One of these is present on disk at the beginning of each media file.
See C typedef for mfm_base_t in mfm_pvt.h

Channel identifier
This is the physical channel associated with the media type from the physical source. Ie: Two tracks of audio from the same source would be differentiated by different channel identifiers.

Media Type
This is an internal identifier indication what type of media data is stored in the file. Ie: video or audio or some other.

File Type
This is an internal identifier as to the format of the media stored in the file.

Name
This is a copy of the character name the user specified as the source of the media data in the file.

UID
This is the unique source medium identifier. This is the uid that the SM tracks and manages in its database.

Start_time
This is the range identifier for the position in the source that the beginning of the media data in this file corresponds to.

End_time
End range identifier

Media_specific
This is a optional area for storage of specific information for this particular type of media.

mfm_quit

Mfm_quit is the procedural called used by the application when the application is quitting. It provides MFM with the opportunity to clean up and write any information necessary out to permanent storage before quitting.

Specifically, the list of current media channels known to exist is sorted and sifted based on the areas in which the channels exist. All the records in the list for those channels existing on a single hard disk are grouped together and written to disk as a single file. This write of information is done using the sectional file write utilities. Once the database is written to disk in this abbreviated form, the file handle is passed to SM (sm_closeNwrite) so that SM information pertinent to the media channels on this disk can also be recorded in the file. MFM is unaware of the format or specifics of the SM information. Once this is done for all existing disk drives, MFM releases any remaining storage used for its run time databases or lists. Control is returned to the caller (the application).

Source Manager

Source Manager(SM) is responsible for the management of all information specific to the physical attributes of the source mediums. Each source medium is assigned a numerically unique identifier (UID) upon initial exposure to the system. To ensure a unique identification, the UID is a random number such as a combination of the seconds since Jan. 1, 1904 and the number of seconds since the system was started. The user specified name of the source is coupled with this unique identifier. This name/unique id pair is the minimum information entered as a record in the Source Manager.

At its most primitive functional level the SM manages the list of source medium names being used or referred to internally in the system at any point in time.

As an additional function the SM is responsible for maintaining the relational connections of source mediums. For example: if two video tapes have been identified with different names, but actually contain the same source video (albeit possibly different time code labelling), the SM is charged with cataloging this information once the user has made the information available. In a more specific and restrictive example it may be the case that only some portion of some source material is equivalent to some other portion of some other source material. This also the SM is responsible for storing and managing. These relationships may exist using different standards of labeling. For instance: SM could store the relationship that a particular piece of film starting at a specific edge number is equivalent to some video tape at a time code for some number of frames of video (or feet of film). This information is available to clients of the SM for whatever purposes are deemed necessary by the clients. One such client in the system described here is the mfm_handle procedural call in the MFM (See the description of mfm_handle).

The run-time SM database is retrieved at each invocation of the application. Specialized procedures are used for retrieval and reconstruction of the SM database. The design and selection of the content of the information stored as well as the retrieval method itself allow the SM to accommodate changes in the media sources available between application runs and mobility of files describing the edited sequences between systems independent of the media associated with them. The SM not only keeps track of the location of the media files and their sources but also keeps track of varying equiva-

lency relationships between the files and portions of files. Given these properties, the SM functions in such a way as to never require the user to also be knowledgeable of the location of this source specific information that the SM maintains. To avoid the need of storing this information in its own localized place, the SM stores the pertinent pieces of its database in the interested client's disk resident files. At the time of application invocation, as each of these clients accesses or opens the files specific to it, the SM is notified and also reads in the pertinent data to it, stored there at a previous time, or by the SM of another system.

Source Manager Procedural Interface

SMInit

Sm_init is the procedural interface the application uses upon invocation in order to initialize the SM data structures. It is called once at this time and not again for the duration of the running of the application.

Specifically, the call uses the linked list manager to set up data structures to accept records of source names and source identifiers and for storage of any relational information between these existing sources. The actual data for the data structures is accumulated at a later time. No file is read in from disk or elsewhere at this time for initial seeding of the SM's list.

SMReadNTable

SMReadNTable is the procedural interface used by clients of the SM, enabling SM to read in data to be added to its data structures. Clients of SM who had in a previous application run provided SM the chance to include information in a file via use of the sectional file utilities use this call to enable the SM to read in the data and place it in the SM data base.

Specifically, the SM processes the call as follows:

First, the sectional file handle passed in the call is queried to determine if there is in fact any name information in the file pertinent to the SM. If there is, the length of the data is determined via a call to the sectional file manager and then the information is read into a block of main memory. Once the data is in main memory the data is traversed and processed. For each record of information it is checked to see if the information is already in the SM's database. If it is, it is skipped, if not it is added. This continues until the entire block of information is exhausted. Once this process is complete, the file is checked for the presence of any SM relational information. If any exists, a block of memory is allocated large enough to hold the information and the data read into it. Once in memory, it is traversed and processed. In much the same way as previous, any new information is added to the SM's database and redundant or repeated information is ignored. Once the process is complete, control is returned to the caller, and any memory allocated is returned.

SMOpenTable

SMOpenTable is the preliminary procedural call used by the caller to inform the SM to prepare for building a list of source identifiers. This list of source identifiers will be later used to determine the pertinent information to be written to a sectional file handle.

Specifically, SMOpenTable initializes a linked list to zero and returns an identifier to the list (i.e., the "list identifier") to the caller. This identifier is used in subsequent calls to SMBuildTable as the caller encounters source identifiers to be included in the file it is creating.

SMBuildTable

SMBuildTable is the procedural interface used by the client to indicate the source identifiers for which the pertinent SM information is to be stored in a sectional file manager handle to be indicated later (SMCloseNWriteTable). The client making this call need not be concerned about indicating the same source identifier multiple times. SM will resolve these duplications later when actually writing the file (SMCloseNWriteTable).

Specifically, the procedure uses a source identifier passed in by the client to locate the record in the SM database and make an instantiation of the record in the list being built. The list being built is indicated by an identifier passed into the call. This list identifier was derived from a call to SMOpenTable.

SMCloseNWriteTable

SMCloseNWriteTable is the procedural interface used by the client to indicate to SM that it should use the source identifiers accumulated in all previous calls to SMBuildTable on the specific list identifier, and write the pertinent SM information for those source identifiers to the sectional file manager specified. The procedure determines the unique list of identifiers, all relational information associated with that list and then also includes any new names introduced by the processing and inclusion of any relational information. This secondary inclusion happens only once and does not cause a recursive iteration of the algorithm. The information pertinent is then written to the sectional file manager handle specified, and control returned to the caller. It is the caller's responsibility to close the sectional file manager's handle.

Specifically, the process is as follows:

First, the list of source identifiers is sorted and then traversed. As the traversal ensues, all duplications are eliminated yielding a list of unique records. Also as a product of the traversal, for each unique source identifier processed, the relational information pertinent to that specific source identifier is added to a list of relational information. Once this is completed, the list of relational information is traversed and processed.

As the list of relational information is traversed, two separate operations take place. First, the relational record is written to the sectional file manager handle specified in the call.

Second, any new source identifiers encountered are added to the unique source identifier list. After the relational list is processed, the source identifier list (with source names) is written to the sectional file manager handle. This completes the process for SMCloseNWrite. Control is returned to the caller.

SMRelated

SMRelated is the procedural interface for clients of the SM to obtain information about source relationships (relational information) that SM is managing. This is the primary function of the SM to the other systems in the application. For a given source identifier and range identification on that source, SMRelated will report any other source identifiers and ranges that have equivalent media. For example: Let us assume video tape A has a copy (or clip) of some material from tape B on it, and that copy of material occurs on tape A from time code 2 hours 7 minutes to time code 3 hours 27 minutes and on tape B from time code 4 hours 17 minutes to time code 5 hours 37 minutes. A caller to SMRelated asking for relations to tape B, time code 4 hours 40 minutes for a duration of 20 minutes, (i.e., a portion of the clip) would receive form SMRelated the information that a

duplicate exists on tape A, 2 hours 30 minutes for a duration of 20 minutes.

Specifically the procedure works as follows. The record in the SM's database specified by the source identifier in the call is located. The relational information tagged on that record is sifted for the ranges specified in the caller's range specification. A list is constructed of all resultant records using the related source identifier and the related range specification. This list is a linked list manager list and the handle to it is returned. Control is returned to the caller. When the application quits via MFM_QUIT, the relations created by SMRelated are written to the MFD **14** on disk by the operation SMCloseNWriteTable which is described above. In this way, the table of relations is preserved in the media database on disk so that its information is easily transported with the media database.

The attached microfiche appendix (incorporated herein by reference) embodies the MFM and SM modules. The programming language and compiler used are THINK C version 3.01 by Symantec Corporation, and the computer used is the Macintosh II running under Mac OS version 6.0.2.

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In addition to the advantages already discussed above, the media storage and retrieval system according to the invention accommodates changes and modifications to the source of media and makes equivalent media available to the client of the method without notification to the client. When more complete media becomes available from another source, or when sections of the requested media are absent in the original media channel given, the source of the media can be changed.

The system offers the capability of dynamically linking the client of the media with the media available at the run time of the application. Such links are possibly different with each run of the system, and channels of media may actually change even after the link is established. The flexibility of the media management system in effect frees the user from making the actual selection of source media as well as keeping track of source media equivalencies, without unduly burdening the process of making the basic identifying request.

FIG. 2 described the digitized media management system according to tone aspect of the invention. Data is stored in database media files and these files are read from the storage device into a working memory where a table of relations is built in response to reading the media files. The working memory accepts a user request for media and the requested media file is located in the table of relations. A handle is returned to the located media file and the media files and the table of relations are written from the working memory to the media file database on a storage device.

Other embodiments are within the following claims.

I claim:

1. A method of managing digitized media data stored in a plurality of media files in a media file database, comprising the steps of:

reading the media files from the media files database located on a storage device into a working memory;

building in the working memory, in response to reading the media files, a table of relations identifying media equivalent to others in at least one common subsection by a source identifier that identifies a media source and a segment of said media source identified by a time range as indicated by lengths, frames, time codes or film edge numbers depending on the type of indexing used on the source media;

accepting a request for an operation on a part of a specified one of the media files, the part being specified in the request by a start time and an end time of the specified media file;

locating the requested media file in the table of relations and, if the requested media segment is not obtained, locating a media file equivalent to the requested media file that satisfies the request;

returning a handle to the located media file; and

writing the media files and the table of relations from the working memory to the media file database on the storage device.

2. A system for the location and management of media subject to user instructions comprising:

a database in which media form at leas one source is stored;

database means for indexing and referencing the media in the database by a source identifier that identifies a media source and a segment of said media source identified by a time range as indicated by lengths, frames, time codes, or film edge numbers depending on the type of indexing used on the source media;

a table for storing equivalency relationships between media;

table management means, separate from said database means, for managing the table of relationships and for determining which source identifiers identify media equivalent to others in at least one common subsection based on time ranges of the source media; and

means for invoking the table management means and database means in response to a source identifier and time range requested by the user to locate the media segment requested by the user and, if the requested media segment is not obtained, an equivalent media segment.

3. The system of claim 2 wherein said database means for indexing and referencing the media in the database is dynamic in that it can change or modify the source of media to a user without notification to a user.

4. The system of claim 2 further comprising a means for invoking said database means for indexing and referencing the media in the database to dynamically link a user with the media.

5. The system of claim 2 wherein said means for determining which source identifiers identify media equivalent to others in at least one common subsection stores only information from its assimilation of data along with, but distinctly separate from, data associated with the means for indexing and referencing the media in the database on request.

6. The system of claim 2 wherein said means for determining which source identifiers identify media equiv-

alent to others in at least one common subsection stores only information from its assimilation of data along with, but distinctly separate from, the storage of information pertaining to segments of source material that the user of the system is using to assemble a desired edited sequence.

7. The system of claim 2, further comprising means for providing for the separation of:

information pertaining specifically to data about source material;

information pertaining to actual digital or other representations of media available to an editing system; and

information regarding source segments that the user of the editing system is manipulating in creating a sequence or producing an edit;

whereby information pertaining to naming, length, positional labeling on the source and associations between said labels and labels on other sources representing equivalent material and other information pertaining to the source in general, is kept separate from other types of information and the only connection between a specific source of media and the physical source it is derived from is a source identifier stored or associated with the media representation stored on or available to the editing system, so that the only information that a user will need to know about such a segment is the source identifier it is associated with, the time range on said source, and a media type identifier.

* * * * *

Pixels and Halide — A Natural Partnership?

By David J. Bancroft

A Los Angeles-based body representing the major film studios, the Technology Council of the Motion Picture and Television Industry, recently proposed a change in the way motion-picture productions are transferred from film to tape for video distribution. The stimulus for the proposal is that the present transfer method is placing an increasing cost and complexity burden on the studios because of the proliferating number of video distribution formats that have to be derived from each film original: to avoid picture-quality compromises, each output variant has typically required a fresh transfer, implying that the full costs of film handling and labor-intensive operations such as color correction have to be borne each time. The Technology Council proposes instead that an electronic representation of the film original be made that is sufficiently generic to all desired output variants that it need be made only once. This article outlines the significant technical features of the Technology Council proposal and considers their implications and impact from the point of view of a manufacturer of the equipment that would be involved, in particular the high-definition telecine and videotape recorder.

Traditionally, film-to-tape transfers have followed the video formats of the distribution chain: 525/60 for North America, 625/50 for Europe, for example. The format selection was always made at the telecine and the chosen electrical standard persisted right through all subsequent processes such as color correction, editing etc., and on to final distribution (Fig. 1). Another selection — which portion of the film image to extract for the relatively restricted size of the TV image — was also made, irrevocably, at the telecine: the video output from the telecine would therefore have both these selections embedded in it.

The Problem with Film Transfers

A decision has to be made when it is necessary to distribute on more than one video standard: assuming that one distribution has already been done for TV only, it is likely for cost reasons that the editing will have been done in video, so there is now an edited video master, say 525-line NTSC, but the film original remains uncut. So, for the next distribution, to a different market, say 625/50 for Europe, the following questions apply:

1. Should the whole transfer (which means color correcting, noise reducing, image stabilization and editing) be done all over again, from the uncut negative or interpositive (IP)?

2. Should the negative or IP be physically edited before any more transfers are done so that subsequent transfers do not require reediting?

3. Can the corrected, edited and, in general, finished 525/60 video master be simply standards-converted to 625/50?

Options 1 and 2 do not compromise on quality but do incur the handling and color correction costs of the transfer all over again. Option 3 is cheaper, but audiences in Europe complained about the quality when this was tried with "Dallas" some years ago (3/2 pulldowns at 59.94 Hz interpolated down to 50 Hz do not look pleasant!). None of these options is particularly attractive. Even if the transfer is of a completed feature film, as opposed to footage destined for editing into, say, a TV series, the labor and expense of redoing the color correction each time is formidable ("color correcting" is really far more than the term implies — a large part of it is deciding which part of the large print density range of the film to capture on the smaller dynamic range of the TV system, often on a scene-by-scene basis).

Now the problem is becoming worse: today, it is not just a question of two or three distribution formats — there may be dozens, if we consider all the permutations. It is a question not only of video scanning formats, but of optical formats too (e.g., pan and scan versus letterbox, optical letterbox within a 4:3 raster, 16:9 anamorphically contained within a 4:3 raster, 16:9

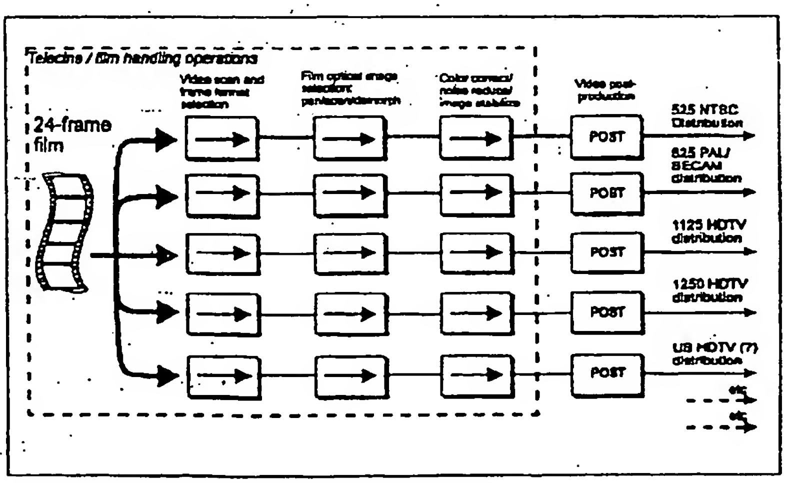

Figure 1. Today's situation: one full pass per output format.

Presented at the 135th SMPTE Technical Conference in Los Angeles (paper no. 135-6) on October 30, 1993. David J. Bancroft is with BTS Broadcast Systems GmbH, Darmstadt, Germany.

inside a raster designed for 1..., etc.), and now HDTV is joining the fray. Figure 2 shows just a few of the myriad combinations with which a transfer facility might have to deal.

Something obviously has to be done about this, and this article gives the viewpoint of a manufacturer responding to a solution proposed by the Technology Council of the Motion Picture and Television Industry at the 1993 Montreux Symposium.[1] This was further reported at the 135th SMPTE Conference by one of the signatories to this proposal.[2]

The Technology Council Proposal

The Technology Council in effect proposes that instead of selecting the output standard for the transfer right at the telecine, as shown in Fig. 1, the decision should be deferred until the last moment. What does that mean in practice?

Figure 3 shows the basic concept — coming out of the telecine is an "electronic representation" of the film. An electronic representation means several things:

- *Preserving the film's temporal sampling characteristics.* A typical film camera can be thought of as capturing all the picture elements of the visual image simultaneously in one exposure at the rate of 24 exposures/sec. To represent this faithfully in a video signal we should ideally use a progressive scan 24 frame/sec scheme.
- *Preserving the film's spatial characteristics sufficiently for the highest distribution standard needed.* To satisfy the most demanding video output formats — HDTV formats — an "HDTV" order of magnitude of pixels and scan lines should be used. An HDTV video distribution derived from film in this way should certainly have no less spatial resolution than the HDTV output format allows.
- *Preserving the film's optical format (exposed or printed area) sufficiently for all output variants.* Considered at the most simple level, that would mean scanning perforation-to-perforation[3] horizontally and frame-top to frame-bottom vertically. This would be the only sure way to accommodate without cropping the vast array of film formats residing in film libraries today.[4]

This electronic representation would then travel through color correction, grain and dirt-effect reduction, image stabilization and (possibly) editing, just once, to the important-looking box at the end — the output format converter.

This box is the point at which a switch is thrown to decide which video distribution format is to be selected, according to which particular market the entertainment product is being sold. What's in this box? Well, perhaps not surprisingly, some of the familiar processes that might have been in the telecine are in there, such as 3/2 pull-down circuitry, pan and scan or letterboxing, with de-anamorphing of images such as CinemaScope, if desired. The important point is that none of these things were locked in, in advance, coming out of the telecine. If the transfer that came out then was truly generic to all these various output permutations, then all of them can be derived from the one electronic archive copy. This archive copy might be called an "electronic inter-positive."

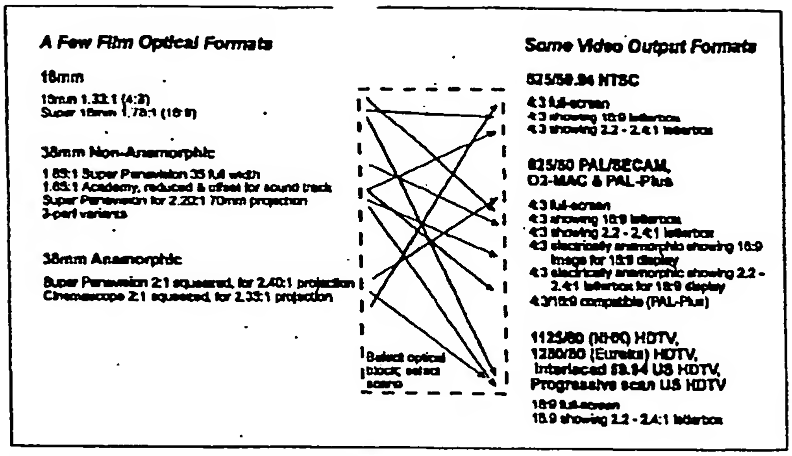

Figure 2. Film and video format combinations.

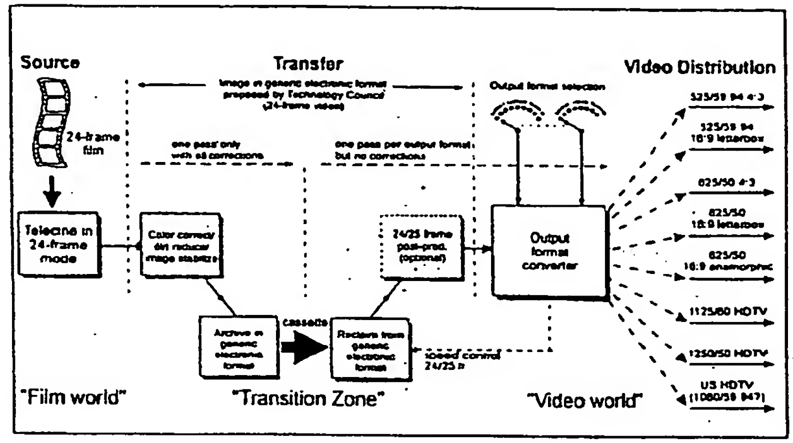

Figure 3. Technology Council proposal: "generic transfer process."

Problems in Implementing the Technology Council Proposal

Now, that's the ideal — how close could we come to this in practice? Well, there are some limitations, of course. Let's look at some of the film formats to see if we can find the extreme cases.

Figure 4 (upper portion) depicts the first challenge. Here the problem is in the vertical axis. The film was shot for 1.85:1 Academy distribution, but protected for 1.33:1 (4:3) television as well. What is meant here is that although the action would have been framed for the 1.85:1 slice in the middle, the director would also have ensured that no alien objects such as lights or mike booms intruded into the areas above and below. Then, when the film gets transferred for conventional

Exhibit 4, Page 2

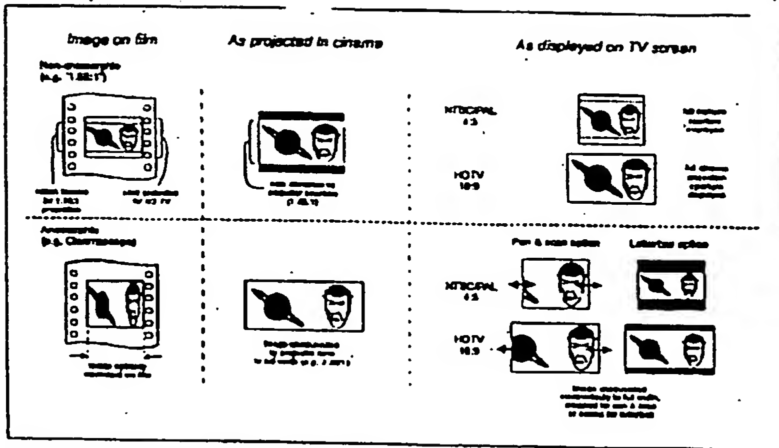

Figure 4. Some optical format combinations.

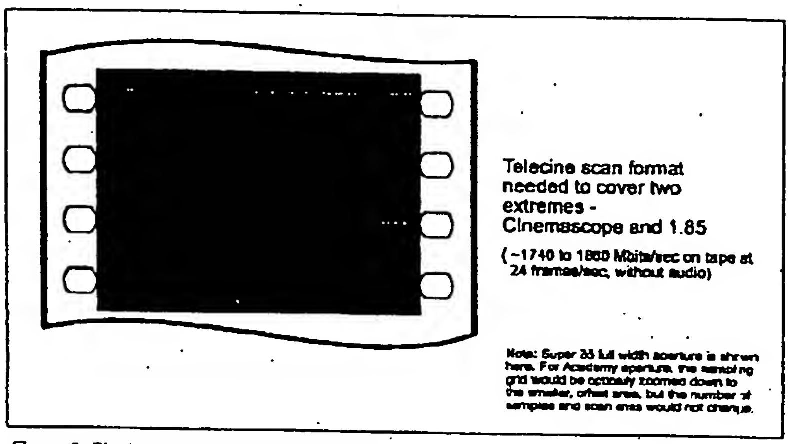

Figure 5. Single truly generic transfer format.

4:3 television, instead of clipping off the sides, these areas above and below are revealed. So now we have the problem that because all of the vertical height has to be scanned to support this 4:3 output, only a fraction of the total scan lines is available for the 1.78:1 (16:9) image. That fraction is about 3/4. In the 16:9 case, which is needed for HDTV distribution, the image really must have full vertical resolution — possibly over 1000 lines. So we have to multiply the number of wanted lines by the inverse of this fraction, i.e., by 1.33, to get the number of lines pumped into the generic electronic master up high enough to yield the full measure in this truncated 1.78:1 output. That makes about 1400 to 1500 lines that need to be captured from the film.[5]

Figure 4 (lower portion) shows the other challenge — CinemaScope. On the film, the image looks almost square, but it really represents a 2.35:1 image, because it's been shot with an anamorphic lens on the camera that squeezes the width of the scene into the available film width and anticipates a corresponding lens on the projector to expand it back out again. This expansion is needed in a video distribution chain as well — either in the telecine or, in this new proposal, in the output format converter box, as previously mentioned. Unlike the cinema screen, however, even the new widescreen video formats can only make a 16:9 image, or 1.78:1 — they can't make 2.35:1, so that means either a letterbox must be created, or — the real challenge — a pan and scan image to make 1.78:1 out of 2.35:1. To maintain full resolution in the pan and scan option it is necessary to store 2.35/1.78, or about 1.32 times the desired final output number of 1920 samples/line in our electronic archive to achieve this — somewhere around 2500 active samples/line.[6]

These two cases probably represent the two extremes of all the film formats likely to be encountered in practice. Between them they might seem to be dictating that the film should be scanned as in Fig. 5, in a format of about 2500 pixels X 1500 lines. However, fortuitously, these two extremes never do in fact occur at the same time — when we need to oversample horizontally with 2538 it is not necessary to oversample vertically with 1440 or 1536. This is shown in Fig. 6, which illustrates a compromise. What is fortuitous is that each of these two cases creates about the same amount of data for the VTR and other downstream equipment to handle. What is less fortuitous is that there are now two formats instead of one. But that does not mean we have lost our goal of only one transfer per film, because each film only needs one transfer of the appropriate type. It does mean, however, that the telecine and all following equipment, such as the VTR, has to be able to accept two formats instead of one.

What It Means to Manufacturers

How should manufacturers react to this? First, even with the compromise dual-format scenario, we are looking at an obviously bigger image sampling array than in any of the HDTV formats that the world has seen so far; the implications for image sensors and for equipment that has to store and manipulate a now-greater-number of pixels are quite profound. Second, just the fact that this sampling array, together with other attributes such as frame rate and progressive versus interlaced scan, are different — from what has so far been etched in silicon and embedded into signal processing architectures and tape formats — is significant. It is not a trivial matter to develop revised versions of products containing such hardware.

One mitigating factor is that the requested frame rate, 24 frames/sec, is 20% lower than 30 frames/sec. That does not help much with the image sensor, but it does with everything else. It could be said that every piece of digital processing or storage equipment has a fixed data rate budget — spend less on the temporal domain and there is more left over for the spatial domain; this would be matching the characteristics of the film source material anyway. Would the increase in spatial data caused by the use of 2538

X 1080 or 1920 X 1440 sampling arrays stay within this 20% extra allowance? Comparing such arrays to, say, 1920 X 1035, an established HDTV format, that would be about 2.75 million active samples/frame versus just under 2 million. Unfortunately, that means not a 20% increase but a 37% increase, going beyond the apparent capabilities of today's HDTV equipment.

Options

What are the options at this point? One suggestion is compression. The argument goes that the film community has accepted the latest technological evolution from the video community: data compression in small amounts: a ratio of 2:1 already seems to be acceptable. If 2:1 compression is acceptable in an interlaced scan format, 4:1 may look just as good in progressive scan. Another suggestion, perhaps less radical, is that 2:1 compression of the color difference signals is already utilized in the ITU/CCIR 601[7] standard-definition digital format (4:2:2 sampling), because of the subsampling compared to luminance, but that factor is limited to the horizontal axis because of interlace. With progressive scan, the vertical axis can be subsampled as well (4:2:0 structure), saving 25% of the total data compared to a 601-like sampling structure. Putting this additional subsampling together with the reduced frame rate would give a total saving of 40% — enough to accommodate the extra spatial samples.

Relationship to Other Parts of the Production Chain

Another issue is the question of the interface between this format, with its strong 24-frame characteristic, and the formats of the various output distribution chains. Of particular consideration are the likely new formats for electronic production of HDTV in the U.S. One of the strong contenders, which has already been noted by the Advanced Television Systems Committee (ATSC)[8] as an interim format for production, is based on a sampling array of 1920 X 1080, with a temporal rate of 60 interlaced fields/sec. This is obviously designed for an easy interface to U.S. distribution standards, both now and in the future. How can a 24-frame format be related to that?

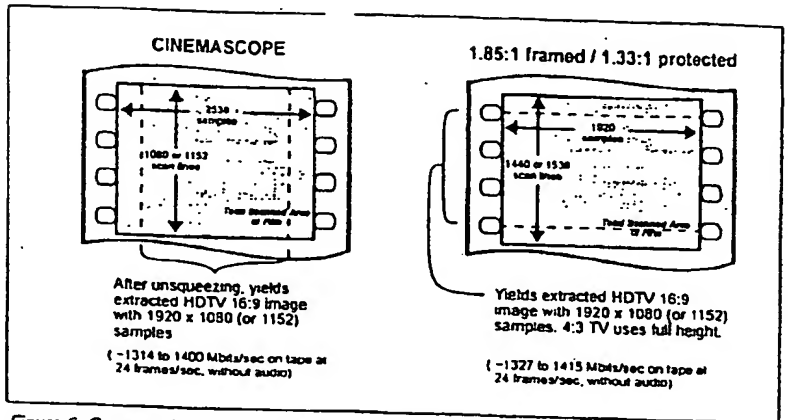

Figure 6. Compromise: dual formats (two extreme cases).

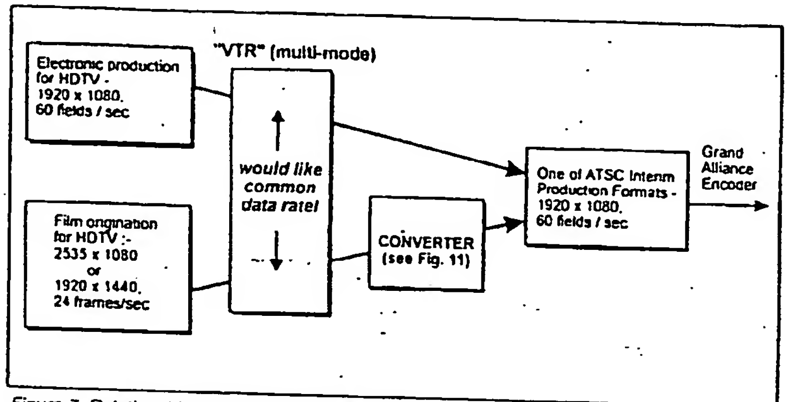

Figure 7. Relationship to ATSC production formats.

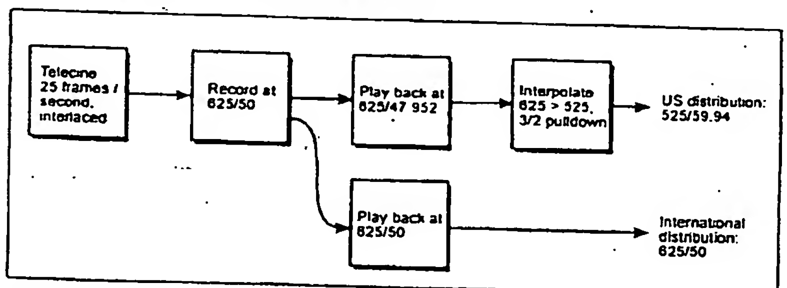

Figure 8. Execution of Technology Council proposal — compromise: illustration using 625/50.

One answer is that telecines all across North America, Japan, and other NTSC countries have been bridging the 24 frames-to-60 fields gap for decades, with the familiar 3/2 pull-down technique. The only difference here is that the bridge would be occurring later on in the production chain. However, there is also the more subtle question of the image sampling array.

One argument could be that the film transfer format should use the same sampling array, or common image format, as the ATSC interim format of 1920 X 1080 previously mentioned. The problem with this is that although it might simplify manufacturing, because of the reduced rather than increased data rate, it would not handle CinemaScope and 1:85 film with the resolution levels defined earlier.

This leads to an alternative concept of a common data rate format, in which the pixel count is increased to take advantage of the lower frame rate, then increased further to achieve Technology Council capabilities, but with the increase being compensated with some modest compression until a clock frequency that matches today's

Exhibit 4, Page 4

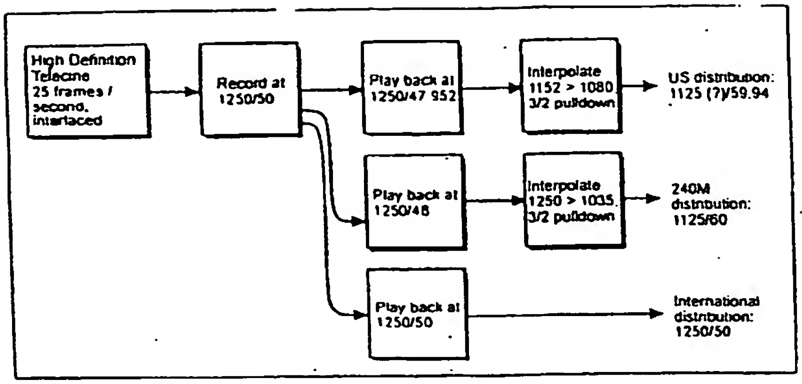

Figure 9. Execution of Technology Council proposal — compromise: illustration using 1250/50.

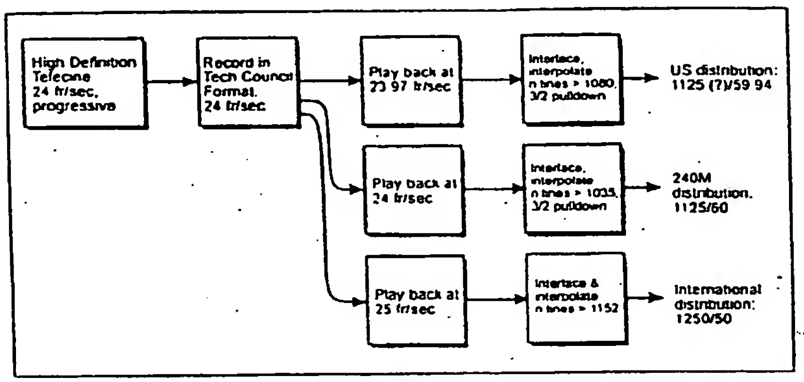

Figure 10. Execution of Techology Council proposal — as requested, using 24-frame video.

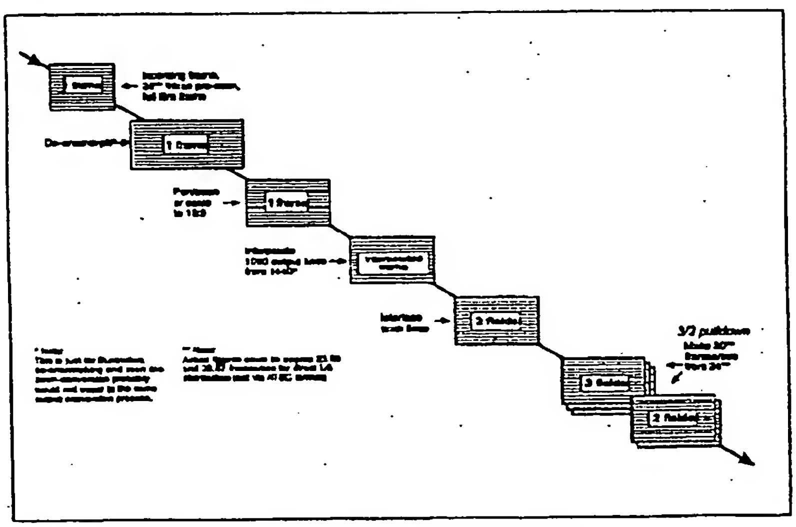

Figure 11. Details of output standard converter — U.S. HDTV case.

proposed HD production formats is achieved. This would simplify the design of switchable equipment, as well as going some way towards meeting those original Technology Council criteria. This idea is illustrated in Fig. 7.

Illustrating the Concept — Regular-Definition TV

As a way to illustrate the concept more simply, consider first the use of 625/50 as the core recording format. As shown in Fig. 8, the telecine plays the 24-frame film at 25 frames (4% faster), onto a 625/50 VTR. Of course, that's interlaced, so the telecine is having to perform what might be called a 2/2 pulldown. That matches European or other 625 distribution as it stands. For the U.S. and other 525-line countries, a little more work is required to get to 30 frames[9] — it is necessary to get back to 24 frames and then use the established 3/2 pulldown technique. However, this is not a telecine — this is a 625/50 VTR. What is needed is to play it at 24 frames/sec or, more correctly, 48 fields/sec, by slowing down all its clock references. That also happens to cancel out the 4% speed error incurred in the original transfer, but most importantly provides the input needed to supply to a fairly simple converter that just repeats fields in a 3/2 sequence, just as the telecine would have done.

Having corrected the frame rate, the remaining task of making 525 lines out of a 625 raster is a relatively simple and clean process. Both major television markets therefore receive a video copy of the film without either one suffering from or paying for any field interpolation. Thus it might be considered to be a traditional 525/625 telecine, but with a tape buffer inside, so the film can be removed and put safely away after the first transfer. Then, the format-setting switches on the tape buffer are simply set to play out transfers in the various TV standards desired. The "buffer" just has to be good enough for whichever is the most demanding standard.

Extending Capability to HDTV

That is the principle illustrated using standard-definition TV distribution. Figure 9 shows a scheme that extends this to HDTV by using not a 625/50 VTR but a 1250/50 VTR. Consider the outputs going to the U.S. Again, by playing back the tape at approximately 48 fields/sec instead of 50 fields/sec, the basis is established for a 3/2 pulldown sequence to make 30 frames or 60 fields/sec. There are some motion artifacts, but they are no different than those created by a telecine making a 30-frame video output via the same pulldown technique. For the raster conversion, to make 1080, 1035, 960, or whatever, out of the 1152 active lines of the 1250 format is not difficult or lossy — converters already exist that do this cleanly. A 525-line raster is a subset, so is again very easy. For

Exhibit 4, Page 5

Europe, a 1250/50 copy already exists; finally, for the 625/50 standard, a 1250-to-625 downconverter is a comparatively simple and lossless device.

What are the disadvantages? First, the signal is interlaced, not progressively scanned. This is not a problem for present-day TV distribution, but for future systems where progressive scan frames may travel all the way to the home, the fields would have to be assembled back into frames again by a converter before transmission. However, because each pair of fields originates from the same film frame and therefore represents the same instant in time, no additional artifacts would be produced by such deinterlacing.

The primary advantage of using an existing format such as 1250/50 is that it exists now; telecine machines[10] and digital 1250/50 VTRs[11] are now appearing on the market, for example. A secondary advantage is that the full gamut of standard-definition 625/50 equipment is available for all offline decision-making processes at very reasonable prices, since the development costs have already been amortized in a large existing marketplace.

Being Truly Technology Council Compliant

For the 24-frame idea, however, Fig. 10 illustrates the same principle as in the 625-line and 1250-line schemes. The disadvantage is that no TV output can be obtained without some conversion (in Figs. 8 and 9 the 50 field/sec outputs were available immediately). One advantage, however, is that a true 24-frame representation can serve more than just television distribution: electronic cinema, for example, might work very well with a 24 frame/sec progressive scan signal projected with the electronic equivalent of a multiblade shutter — possibly a 72-Hz refresh to abolish flicker on a large-screen display where the brightness might be much higher than on today's traditional cinema screens.

Figure 11 illustrates in detail what would go into the output standard converter referred to earlier. The order of processing shown here is intended only to demonstrate the concepts; a manufacturer of the actual device might plan the architecture differently, but these processes would be in there somewhere.

This leads to Fig. 12, which summarizes the functions that would be relocated from the telecine to the output converter as a result of adoption of the Technology Council scheme.

Finally, Fig. 13 presents the challenge to manufacturers — mostly in the form of more pixels, more data, and revisions to existing architectures that have been derived from broadcast standards.

TELECINE	HD VIDEO RECORDER
• Replace sensors to increase horizontal samples	• Allow 24 frame recording & playback
• Increase clock rate to deliver ~1500 lines to output	• Allow playback at frame rate different from recording
• Bypass interlace and 3/2 pulldown circuitry	• Allow progressive scan format
	• Accommodate external data rate ~30-40% greater than broadcast HD data rates

Figure 13. Some impacts of Technology Council proposal on telecine and HD video recorder.

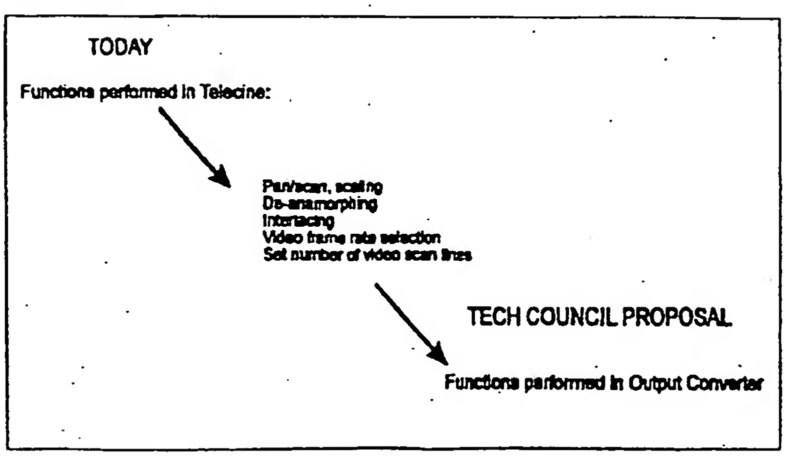

Figure 12. Comparing the Technology Council proposal with today's transfer method.

Conclusion

It may be that a compromise will have to be reached between these Technology Council ideals and what manufacturers can actually build, but ultimately, no manufacturer can push his format, or any particular format, upon the production or post-production community. The users must decide on the most harmonious partnership between pixels and halide.

Endnotes and References

1. Position statement, Technology Council of the Motion Picture and Television Industry, Montreux, Switzerland, June 1993.
2. R. J. Stumpf, "Defining a Film Digital Mastering Format — A Project of the Technology Council of the Motion Picture-Television Industry," presented at 135th SMPTE Technical Conference Los Angeles, Oct. 31, 1993.
3. In the case of a release print that has sound tracks on it, the scanning should cover the full limits of the printed picture area.
4. *American Cinematographer's Manual*, ASC Press, Hollywood: 1993.
5. The exact numbers are 1440, to give 1080 active lines out (U.S. distribution); and 1536, to give 1142 active lines out (European distribution).
6. The exact number is 1920 X 2.35/1.777 = 2538.
7. International Telecommunications Union (ITU/CCIR) Rec. 601.
8. Letter from R. Hopkins, ATSC Committee, to K. Davies, SMPTE, Aug. 17, 1993.
9. The rate is actually approximately 29.97 frames/sec.
10. D. Poetsch and A. J. Cosgrove, "A Digital CCD Telecine for HDTV — Joint Development of Eastman Kodak and BTS GmbH," 135th SMPTE Tech. Conf., Oct. 31, 1993.
11. J. K. R. Heitmann, W. Schiffler, and H. A. Vaanholt, "An Experimental Digital 1.2 Gbit/sec VCR for 1250/50 HDTV Signals as a Base for a Truly Universal Recording Format Handling Data Signals of Various HDTV Standards," presented at 135th SMPTE Technical Conference, Los Angeles, Oct. 31, 1993.

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審査請求　未請求　請求項の数 1　（全3頁）

㉔発明の名称　24フレーム／秒のビデオシステムによる映画製作法

㉑特　願　平2－144373
㉒出　願　平2(1990)6月4日
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明細書

1. 発明の名称

24フレーム／秒のビデオシステムによる映画制作法

2. 特許請求の範囲

1. 映画制作において撮影されたフィルム画像を24フレーム／秒でテレシネし、ビデオ編集したのち、それに基づいて従来のポジ編やネガ編集を進める映画制作法。

3. 発明の詳細な説明

本発明は、映像を記録し、再生する方法にかかわり、24フレーム／秒のビデオシステムによる撮影・録画・編集をもととして、映画フィルムの標準再生スピードである24駒／秒と合致させることによって、映画制作にかかわる創作的作業工程（主に編集・ダビング）を容易・確実・迅速にすることや、作品の著作権保護などを目的としている。

従来のビデオによる記録・再生はカラーにおいては、29.97フレーム／秒（一般的には30フレーム／秒としている。）であり、テレシネは主に2－3プルダウン方式にみる様に、映写時間を視覚的におかしくない程度に改造しているが、原理的には以下の問題を残している。

① 24駒／秒で再生される映画フィルムと、30フレーム／秒のビデオ画像のそれぞれ一枚の画が対応する実時間の違いに対する問題。

② 実際の画の動き、流れ、フリッカーの問題があり

以上のことにより映画制作工程中にビデオを利用することは、原理的に問題を残した。

本発明は上記①、②の欠点のない映画制作を行なうことを目的とし、以下に述べる方法によって、それを解決している。

すなわち、フィルムをテレシネするときに24フレーム／秒のビデオによる方法を用い

て映写の標準スピード24駒／秒にすることで解決している。

24フレーム／秒のビデオによる方法

○ビデオカメラの基準発振の新設、改造。
○ビデオレコーダーの記録・再生回路の改造。
○ビデオディスプレイ（ブラウン管、ビデオプロジェクター）の改造。
○フィルム映写機との同期、位相結合の設定。

これらのことにより、フィルム画像は、テレシネ後、24フレーム／秒でビデオ化され、フィルム再生と同じ状態を保つことができる。

よって、前述した①、②の問題がなくなり、以下の様な映画制作における効果をもたらす。まず、

○撮影現場では、この方法でフィルムカメラよりビデオ画像を取り出すことにより、本番の画像を24フレーム／秒でフリッカーなしで記録・同時再生ができる。　またフィルムカメラとビデオカメラとの同期位相を適度に設定することで、通常とらえられない、"仕掛けもの"などの記録・再生・確認に役立つ。もちろん、監督やスクリプターの確認と整理にもフリッカーなしで役に立つ。

○編集においては、従来の映画制作のポジ編集ではこのシステムのビデオ編集をもって容易、迅速に、かつフィルムの駒とビデオのフレームのエラーがまったくないので数百カットに及ぶ映画編集と、その処理に耐える正確さを示すこととなる。いわゆる予備編集的なものから、荒編・オールラッシュ編集までの工程がこのシステムでは、ビデオにより対応することとなる。また本格的なビデオ処理を含む表現行為ができ、フィルム工程に考えを示すこととなる。とりわけスタッフに対しては種々のバージョンによるプレゼンテーションが可能となる。これらのことはワンカメラスタイルにはじまる日本映画の各作家制作形態の中にあっては制作スタッフのイメージの参入をもたらし、スタッフ、関係者、アドバイザーなどの相互のコミュニケーションを高める結果となる。この工程でビデオ編集・処理・特殊効果などを行なうことは、以下のことによって、このシステムをさらに効果的なものとする。今日の30フレーム／秒のビデオ世界では一般的になりつつあるタイムコードアドレスを、まだ積極的に使用されていない、フィルム・タイムコードとこの24フレーム／秒のビデオシステムを組合して使用されるならば、なんべんでも、手軽に、正確に、反復作業が行なえ、自己確認が容易となる。また関連機器と合わせれば、編集のシート作成や、ポジ・ネガの切り出しが簡単に行なえることとなる。

○音楽作りでは、ビデオのもつ小型・簡便性や音楽機器の発達に対応しやすいなどの特徴から、特殊処理も含めたプレゼンテーションにより画の時間と音楽的イメージ創作を広げることとなる。

○ダビング時では、ビデオプロジェクターなどにより、大画面で見ることができ、ビデオレコーダーにおいては、従来のフィルム映写機より簡単にスタート、ストップ、リピートができ、高い作業性をもつ。また併用することにより細部の表現まで高めることができる。

○教育研究においては、とくに映画の名作などの研究、解析においては、この方法により、一駒、一駒、正確に分析することができる。また、フィルムをいためることは無論少なくなる。

○ソフトサービスと著作権保護

この方法を広く、今日の映像世界の中で見渡せば、ビデオの簡便性をもち合わせたクローズドなシステムであります。　この点を留意すれば、企業の非公開の研究資料などのビデオ化保存には役に立つこととなる。また、各国のフィルムライブラリーにはじまり、博物館、公共機関などの、保存を前提にしながらも、特定の人々・機関にそのソフトの公開性をもつ、いわゆる会員制のサービスにおいても、オリジナルの保存・著作権の保護とい

う意味からも期待できる方法と考える。（暗証コード入りのカード使用で二重の著作権保護とサービスアップをはかることができる。）

○このシステムによって、２４駒映画アニメーション・セル画の動画チェックなども正確、迅速に、初心者でも行なうことができる。

以上、今日の映画制作にもどれば、資本不足のため悪い意味で閉鎖的、職人的に終止せざるえなかった部分さえも、安価でこのシステム方法を用いることにより、スタッフワークとコミュニケーションが広がり、合理的で科学的、かつ創造的で教育的効果のある新しい映画制作法となる。

特許出願人　　檜山茂雄

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(54) PRODUCTION OF MOVIE BY 24 FRAMES/SEC VIDEO SYSTEM

(57)Abstract:
PURPOSE: To easily, surely and rapidly execute the working process of movie production by matching photographing, picture recording and editing based upon the video system with the reference reproducing speed of a movie film.
CONSTITUTION: When a video camera, a video recorder and a video display are modified and the synchronism and phase coupling of these modified units with a film projector is set up, film images are converted into video images at the speed of 24 frames/sec after telecine processing the film and the film can be held at the same state as film reproduction. Thus, problems such as a real time difference between a movie film and video images and the movement, flow and flickers of pictures can be resolved.

JAPANESE LAID-OPEN PATENT APPLICATION H04-37846

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SPECIFICATION

1. Title of the Invention

MOVIE PRODUCTION METHOD BY A VIDEO SYSTEM OF 24 FRAMES PER SECOND

2. Scope of claims:

(1). A movie production method of carrying out conventional positive editing, negative editing and the like based on video edition of film images captured for movie production telecine-processed at 24 frames per second.

3. Detailed Description of the Invention

The present invention relates to a method of recording and reproducing images, and aims at making the creative operation process (mainly edition and dubbing) related to movie production straightforward, accurate and faster, as well as protecting copyrights ant the like, by means of matching with the movie film's standard reproducing speed of 24 frames per second, based on image capture, recording and edition by a video system of 24 frames per second.

Recording/reproducing of colored conventional video is carried out at 29.97 frames/s (in general, it is said to be 30 frames/s), and although the telecine has been remodeled to the extent of being visually acceptable at the projector side as it can be mainly observed in the 2-3 pull-down methodology, there are the following fundamental problems left unsolved.

□ The problem related with substantial time difference in

making correspondence of respective single pictures between a movie film reproduced at 24 fps and video images of 30 fps.

□ The problem of movement, slip and flicker of the actual picture.

From the above situation, there were fundamental problems left in using video within the movie production process.

The present invention aims at performing movie production without the above-mentioned drawbacks ① and ②, and solving them through the method described below.

In other words, it solves the problems by setting the standard projection speed to 24 fps by utilizing a method of a 24 fps video when telecine-processing a film.

Method of video of 24 frames per second

- ○ New conception, remodeling of standard generation for video cameras.
- ○ Remodeling of video-recorder's recording/reproducing circuit.
- ○ Remodeling of video display (CRT, video projector)
- ○ Synchronization with film projector, phase-coupling setting.

From the above, the film image is converted to video at 24 fps after telecine-processing, thus permitting preserving the same conditions as the film reproduction.

As a result, the aforementioned problems ① and ② are solved, leading to benefits for movie production as follows.

First,

- ○ In the image-shooting site, by removing video images from the film camera through this process, it is possible to perform recording/simultaneous reproducing of the

original pictures at 24 fps without flicker. In addition, by conveniently setting the image formation phase between the film camera and the video camera, it becomes useful in recording/reproducing/verifying "special effects" or the like, which could not be regularly captured.

○ As for editing, by applying the video editing according to the present system to the conventional positive editing for movie production, the process becomes straightforward, fast and absolutely free of errors between the film frame and video frame, thus presenting an accuracy that makes the process resilient against movie editing of hundreds of cuts and its processing. The process that goes from the so-called preliminary edition through rough cut to all-rush edition will all correspond through the video according to the present system. In addition, representation is made possible including full-fledged video processing, thus permitting to concentrate ideas on the filming process. This will especially allow the staff to perform presentations of various versions. These facts will give room to participation of images from the production staff into each operation production mode of the Japanese movie system of one-camera style, thus resulting in improving the communication between staff, related people, advisers, etc. Performing video editing, processing, special effects and the like at this process makes the present system further effective for the reasons mentioned below. By utilizing the time code address, which is bound to become general rule in the current 30 fps video world, coupled with the film time code and the video system of 24 fps, which is still not actively utilized, it becomes possible to carry out repetitive operation

straightforwardly and accurately, and self check is also made easy. In addition, by combination with related equipment, it becomes easy to prepare editing sheets, as well as to carry out cuts for positives and negatives.

○ As for music composition, from the characteristics that videos have of being compact and easy to manipulate, as well as their easy adaptability to the development of musical equipment, it may expand the time and musical image creativity for pictures by permitting presentations including special effects.

○ As for dubbing, it shows high operability as permitting easier start, stop and repeating than conventional film projectors for video recorders, since its is possible to visualize in larger screens through video projectors and the like. In addition, through its use in association, it is possible to increase representation of details.

○ As for educational research, it is possible through the present method, to perform accurate analysis, frame by frame, especially for research and analysis of renowned movies and the like. In addition, film damage is obviously eliminated.

○ Software service and protection of copyrights

Viewing the present method from the perspective of nowadays' imaging world, it can be said that it is a simple and straightforward closed system. By paying attention to this point, it becomes useful for the preservation in video form of companies' non-disclosed research material and the like. In addition, it can be considered as a prospective method in the sense of preservation and protection of copyrights of originals even for the so-called members-only services that has the primary purpose of preservation but also

have the characteristics of disclosure of their software to specific people or organizations, from film libraries that each country has to museums, public organizations and the like. (by utilizing cards with secret codes, it is possible to pursue double copyrights protection and improvement of service quality.)

○ Through the present system, it becomes possible even for beginners to check 24-frame movie animations/celluloid pictures accurately and fast.

As above mentioned, the staff work and their intercommunicability can be expanded by utilizing the present system's method in an inexpensive way, even when looking back to nowadays' movie production world which has been reclusive in the backward sense of lacking enough funding and relying thoroughly on craftsmanship, constituting a rational, scientific and constructive new movie production method with educational impact.

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